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from Mrs Benj. Haskell —
one of Dr. Haskells books

A MANUAL

OF

CLINICAL MEDICINE

AND

PHYSICAL DIAGNOSIS.

BY

THOMAS HAWKES TANNER, M.D., F.L.S., &c.

THIRD AMERICAN
From the Second English Edition,

REVISED AND ENLARGED BY

TILBURY FOX, M.D., Lond.,
PHYSICIAN TO THE SKIN DEPARTMENT IN UNIVERSITY COLLEGE HOSPITAL.

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EDITOR'S PREFACE

TO

THE SECOND EDITION.

THE present work, in its First Edition, has been for some time out of print, and the demand for it has continued. The Author's engagements, however, have not permitted him to prepare a Second Edition, and that task has therefore been committed by him to the Editor.

The aim of the work is to help the student to learn disease; to be his companion when he goes into the ward or out-patients' room of the hospital, describing for him the symptoms and signs of diseases, the conditions under which they arise, and the mode of detecting and recognizing them.

But if designed for the student, it is quite clear that the manual must also become—if it succeed in its object—a book of reference for the practitioner as regards the diagnosis of disease, and it is of especial value to him, as it includes an account of the Clinical Examination of persons for Life Assurance, and the points to be attended to in Medico-legal Investigations generally.

Remembering this, the Editor has taken great pains to enhance the value and popularity of the work. He has avoided such detail as cannot be used at the bedside.

A great deal of new matter has been added.

The Medical Anatomy of regions and organs—especially of the heart—has been amplified. The position of the healthy organs as standards for comparison in disease being given at greater length.

The Laryngoscope, Ophthalmoscope, Sphygmograph, and Thermometer; the proper mode of using them, and the indications which they afford in regard to disease, are each the subjects of special sections.

It has been deemed advisable, also, to insert a section on the Administration of Chloroform, the apparatus used for the purpose, and the dangers to be guarded against. This will be equally useful to students and practitioners.

The table of Feigned Diseases has been elaborated, and now forms a reference of considerable value.

The characters of Pericardial and Endocardial Diseases, and of the murmurs to which they give rise, have been likewise described in greater detail.

An account of the diagnostic features of the more important Abdominal and Cerebro-spinal Diseases has been added in the present edition; and in the section on the urine, in Chapter XVI, the processes for determining quantitatively the amount of sugar and urea in the urine—which every student should know—and a description of casts, &c., will be found for the first time.

These are some of the more important additions to the work in its present form, which the Editor hopes will be found by the student the most useful and handy work on Clinical Medicine yet published. The Editor has acknowledged several obligations under which he labors, in the text.

1*st October*, 1869.

PREFACE

TO

THE FIRST EDITION.

THE following pages have been written with the intention of removing some of the difficulties which the student always—and the practitioner frequently—must encounter, while studying disease in its Protean forms at the bedside. Remembering my own impressions of bewilderment on beginning to "walk the hospital," I have honestly endeavored to simplify the task for others; and should this treatise be the means of doing so, I shall feel greatly rewarded for my exertions.

February, 1855.

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A MANUAL

OF

CLINICAL MEDICINE.

CHAPTER I.

ON THE CLINICAL STUDY OF DISEASE.

SECTION I.

ON THE FACULTY OF OBSERVATION.

ALL who have studied the writings of the greatest of philosophers—Lord Bacon—must know that there are two especial sources to which he refers men for real increase of knowledge, namely, to observation and experiment, which he insists are but questionings of Nature in respect of specific matters To cultivate the faculty of observation must then be the first duty of those who would excel in any scientific pursuit,[1] and to none is this study more necessary than to the student of medicine. Without the habit of correct observation, no one can ever excel or be successful in his profession. Observation does not consist in the mere habitual sight of objects—in a kind of vague looking-on, so to speak—but in the power of comparing the known with the unknown, of contrasting the similar and dissimilar, in justly appreciating the connection between cause and effect, the sequence of events, and in estimating at their correct value established facts. The great Newton has assured us that he knew of no difference between himself and other men but in his habits of observation and attention, and almost the same encouraging remark is made by Locke. The right and ready use of the knowledge gained from true observation makes the successful practitioner.

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[1] "L'art d'observer est le seul moyen d'acquérir des connaissances utiles."—LA CROIX.

The constitution of the human mind is such that the acquisition of knowledge can only be very gradual. Just as there is no royal road to learning, so there is no rapid method of gaining experience; and he who wishes to excel, must not only work assiduously, but must be careful that he toils in the right direction. The tendency at the present day is to jump at conclusions upon insufficient data—that is, to be content with superficial observation—in the race for notoriety and success. Although at first the difficulties in the way of observing correctly may appear insurmountable, yet as the habit is daily encouraged will the path become clear, until at last what was at first a labor becomes a matter of almost routine practice.

The most important part of the medical man's education is undoubtedly to be gained at the bedside. In the wards of our various hospitals every diversity of ailment, every variety of injury may be carefully observed and investigated in their various stages, as well as the modifications produced upon these ailments, by a careful use of those remedial agents which have been so bountifully bestowed upon us. In order, however, that the observation of disease may be profitable, it must be complete. It will be useless unless the malady be watched during its whole course, the symptoms, as they arise, noted, and the effects of medicines carefully observed until the termination in recovery or death. Especially is the termination of a case instructive, and not the less so when the result is death, since we may then mark the way in which the patient succumbed, and learn to guard against such an event in similar examples for the future.

The student has then, at the outset of his career, to collect facts by the simple use of his senses, carefully trained to an exact appreciation of impressions made upon them. He should describe what he sees and hears in the simplest possible language, and take nothing for granted—nothing on hearsay, but see and feel for himself. He may leave the explanation of phenomena for awhile until he has acquired the habit of accurate observation. Unless the student acquire the faculty of correct observation, and use it for himself, he will only collect data which are unreliable, and his reasoning thereon will necessarily lead him utterly astray. And he cannot supply the deficiency from books, or borrow it from others. Now just as a man who wishes to become acquainted with the nature and characteristics of a foreign country may read a whole library on the subject, inspect charts and panoramic views faithfully drawn, or study a series of paintings delineating separately all that is most worthy of observation, and yet certainly fail to obtain any correct idea of the distant land ; so may a student learn the entire practice of physic by heart from books, and yet be unable to distinguish small-pox from measles when called upon to put his theoretical knowledge into actual practice. Valuable therefore, and indeed indispensable, as is the assistance to be derived from a careful study of the writings of the masters of our profession, yet these writings must be regarded principally, if not solely, as guide-books, that is to say, as intended to smooth the difficulties which the observer will have to encounter, but by no means calculated to do away with the labor of self-observation ; for it is not too much to say that without practical experience all other acquirements are of no avail to the practitioner of medicine. Truly excellent, then, is the advice given by Dr. Latham to the student, "Begin by learning to stand by the sick-bed, and make it your delight." He who will be content to do this in a right spirit, may be assured of becoming an eminently useful member of the noblest profession that can engage the attention or encourage the development of the highest qualities of the mind of man : let him but work diligently, perseveringly, and conscientiously, and he may be certain of ultimately acquiring—if not the purse of Fortunatus —at least a competence ; but, above all, will he experience that happiness which princes may envy, but which they cannot bestow, the gratification of knowing that—in however humble a degree—he is the honored instrument of "God, who healeth our diseases."

SECTION II.

THE GENERAL CONDUCT OF THE MEDICAL PRACTITIONER.

Much might be advantageously written upon this important subject, but a very few remarks must suffice. The mere fact that the practice of medicine arose from an instinctive impulse to relieve the pains and sufferings of others, is sufficient to show that the medical man, of all men, should be free from that vice which is the besetting sin of mankind—selfishness. He must, indeed, be thoroughly content to live, not for himself, but for others ; not to look to his own interests, not to be guided in his actions by motives of policy, but to let the rule of his life be to do as much good to others as possible. He should think as little of pecuniary rewards as is compatible with his own interest and that of his brother practitioners, remembering the maxim adopted by La Bruyère from Confucius—that he who esteems gold more than virtue, will be likely to lose both gold and virtue. The physician, to be successful, must not only possess a sound practical knowledge of his profession, but he must also be careful that his moral character be free from blemish ; that his general conduct be not only above vulgarity, but such as to excite the respect of his friends and neighbors ; that he be conscientious, attentive, careful of the secrets of those who consult him, unmindful of the worldly condition of his patients, sympathizing, calm, and circumspect in his behavior generally. As it is his object to prolong life, so he must leave no means unpursued in order to attain such object, remembering that the mere prescribing of medicines is often the least part of his duty. It would indeed be well if medical men generally thought more of the *moral* remedies at their disposal: and if more attention were bestowed upon soothing the fleeting moments of the afflicted, by inspiring them with hope, confidence, and ease of mind. A man who practises his profession conscientiously will never be unmindful of the duties which he owes to his colleagues—to those treading the same path as himself. He will be most tardy in believing ill reports of his fellow-practitioners, from a knowledge that their conduct is really distorted by disappointed or exacting patients ; he will carefully avoid all such short-sighted proceedings as may tend to elevate himself by depressing others ; he will strictly eschew special and unusual methods of obtaining notoriety, newspaper puffing or prescribing, remembering that such behavior dishonors the profession to which he belongs, as it injures most in the end the man who practises it ; and he will hesitate at giving, as a rule, gratuitous advice, where such is not needed by the circumstances of the patient, and where such a course of proceeding must injure those who are content to receive a small remuneration for their toilsome labors, and whose daily bread probably depends upon their obtaining such a return for their exertions.

The encouragement bestowed upon medical men is for the most part very deficient; their worth and usefulness being unacknowledged, their fatigues and anxieties unheeded, and their unselfishness and disregard of wealth abused. While striving to diminish the sufferings of their afflicted fellow-creatures, can it happen otherwise than that their feelings should be hurt by observing the attention paid to men practising the most palpable absurdities and deceptions, by witnessing the success of homœopaths, table-turners, mesmerists, and such like. Has it not, however, always been so? Does not Bacon himself tell us, that "the weakness and credulity of men is such, as they will often prefer a mountebank or witch before a learned physician;"[1] and is the present age less credulous than that of the great philosopher? We fear not! But it is the prerogative of superior minds to rise with the occasion. Let us, therefore, individually and collectively, as students and practitioners, strive to improve our art: let us each endeavor to attain that mental sagacity which will enable us to perceive the important features of cases coming under our care, and the salient points of diagnosis: that wisdom which can foresee the course and progress of disease; that judgment which will enable us to select the proper remedies; and that calm determination which will render us capable of insisting that the necessary measures are thoroughly carried out.

SECTION III.

GENERAL REMARKS ON THE CLINICAL EXAMINATION OF PATIENTS.

Upon the application of a sick person to a medical man, it often happens that the sufferer is embarrassed by the novelty of his situation and by general debility resulting from his malady, we must therefore try by calmness, delicacy, patience, and kindness on our part to put him at his ease, which will be readily done by one who has accustomed himself to intercourse with invalids. A few remarks on general subjects, inquiries as to his place of residence, and the length of time he has suffered from bad health, will calm the patient, and meanwhile the practitioner is enabled to learn much from—

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[1] "The Advancement of Learning."

An Examination of the Exterior, the physiognomy first engaging attention, since from it may be learnt the patient's apparent age, strength, state of mind, complexion — whether pale, florid, or dusky—and his general constitution. The general bulk of the body should then be cursorily examined, noticing whether it be large or full, or thin and wasted; the condition of particular regions, whether swelled or attenuated; the presence or absence of any cutaneous eruptions; the posture; character of breathing; the nature of the pulse; an excitable or melancholic manner can also be noted, and lastly, evidence is to be obtained as to the powers of voluntary motion, in the use of the arms, of the legs in locomotion, the existence of any peculiarity of gait, irregular muscular movements, &c.

Interrogation of the Patient.—We are now prepared to interrogate the patient himself, and this we do by inquiring whether he has any pain, where it is seated, and the length of time he has been ailing. This leads him to enter into a description of his sufferings, and of the means he has adopted for their relief; and although in many instances he may not make his statement the short simple narrative we might desire, yet, as a general rule, it will always be better to let him tell his own tale in his own fashion. Then, according as complaint is made of suffering in any particular organ, we proceed to investigate the condition of this and of all parts connected with it. Thus, suppose pain be complained of in the head, we proceed to make an examination of the cranium. Or, perhaps, the seat of disease may appear to be in the thorax. We then make an examination of the thoracic viscera, resorting to inspection, palpation—or the application of the hand, mensuration, percussion, and auscultation, in the manner to be hereafter noticed. The characters of the expectoration, if present, are noticed. It may be in other cases that attention is specially directed to the abdomen. Then an examination of this part must be made by inspection, measurement, palpation, percussion, and auscultation. The boundaries of the liver, spleen, and stomach must be ascertained: the nature, duration, and seat of pain, if any; the presence or absence of tumors, and hernial protrusions; the condition and number of the alvine evacuations; the mode in which digestion is performed, and the state of the appetite; and the characters of the renal secretion, and such like.

It then remains for us to endeavor to ascertain accurately the present condition of the patient, the state of his skin as to its temperature, &c., the condition of the tongue, and the nature of the pulse. His real age, profession, whether married or single, constitution, habits and mode of living, usual state of health, &c., are then to be inquired into, and we conclude by ascertaining the causes of the disease, whether it be hereditary or acquired, whether the present is the first attack or otherwise, and the ability of the sufferer to undergo the necessary treatment.

There are, of course, many circumstances which often prevent our making an examination in the exact manner just described. Thus, in many instances, we have to depend for much of our information on the testimony of relatives or friends, or we may even be called to a person who is quite insensible, and we may be unable to obtain any history at all. The educated practitioner, however, will be at no loss how best to proceed on such an emergency. These remarks apply to the general run of cases, but there are some special points to be noticed in reference to females and children.[1]

Examination of Female Patients.—In examining into the history of a female patient, we must pay peculiar attention to the condition of the sexual system, ascertaining especially whether the patient is single, married, or widowed; the number of her pregnancies and of her children, and the date of her last labor; the manner in which the catamenial function is performed; and the presence or absence of any leucorrhœal or other discharge. As a general rule it is of importance to examine the patient's system and body generally when he or she first comes under observation. Patients often show or call attention to the "worst part" only, and secondary mischiefs which have great influence in helping out a correct diagnosis, or which retard the cure of a patient, frequently go undetected from the imperfect inspection of the sick person by the practitioner.

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[1] The student may consult "Hints to Clinical Clerks in Medical Cases," and "The Mode of Interrogating a Patient," recommended by Dr. Spillan in the introductory chapter of his translation of Andral's "Clinique Médicale."

SECTION IV.

THE CLINICAL EXAMINATION OF CHILDREN.

The importance of attending to the diseases of children cannot be too much insisted upon, especially seeing that so serious are their maladies, and so great is the mismanagement to which young children are often subjected, that it has been calculated one child in every four dies within a year of its birth, and one in three before the end of the fifth year; while of the deaths occurring within the first year, nearly one-third are said to take place before the end of the first month. Some authorities even estimate the mortality as higher than this. In many of the large manufacturing towns of England, the Registrar-General's Reports give a proportion of nearly one-fourth for the males, and one-fifth for the females, under one year of age, out of the whole number of registered deaths.

In no case perhaps does the practitioner so much stand in need of a certain tact as in investigating the disorders of childhood. But, by patience and good temper, by a quiet demeanor and a gentle voice, all may be made to go well, and a diagnosis may be formed almost as easily as in the case of adults. The first point is to be careful not to alarm the patient, but on entering the room to learn quietly the previous history of the case from the mother or nurse, the circumstances under which the present illness has come on, its early symptoms, the child's sex and age, the nature of its food and whether it has been weaned, the state of the bowels and the nature of the evacuations. Sir William Jenner's directions to his class in reference to the mode of examining children are somewhat as follows. After stating that the diseases of children are not ill-defined, he proceeds to say that if called to a child, and it be asleep, the practitioner should not wake it, but whilst it is asleep he should note its attitude and position, whether it lies covered or uncovered, if with its legs drawn up or not, if it lies on its back or its side; the two latter points indicating the degree of strength, and the seat of pain. The color of the cheeks (heightened in pneumonia and typhoid) should be noticed, or local sweating, especially about the head, as is the case in rickets; so also the expression of the face, which is calm in health; moans, startings, twitchings, shrieks, catching of the hands, suggesting cerebral mischief, or twitching of the mouth, gastric irritation. We then note if the nares act markedly, as in acute chest diseases; whether the eye be completely closed, as in health, or half closed as in cerebral disease; if the respirations be quickened (they are from 24 to 30 in health). If the child is awake the pulse is readily excited, it should therefore be felt in sleep, the hand being warmed for the purpose. The pulse of a healthy child under two years may beat from 90 to 140 or more; after three years, not above 100. The state of the fontanelles should be noticed, their size, tension, and pulsation, when the child is awake. A very rapid pulse is little guide to disease in children; a slow pulse is of more consequence. When the child wakes, the expression, state of surface, and position may be observed; a smile is inconsistent with serious illness. In abdominal affections, the mouth is pinched up, the legs drawn up; the expression is one of suffering in colic, of languor in typhoid, there is a wasted look in chronic diarrhœa, a "shrivelled" face in muco-enteritis, an earthy hue of skin, with fissured corners of the mouth and condylomata in congenital syphilis. Always pass the hand over the head, which is enlarged in hydrocephalus, rickets, and hypertrophy of the brain, the fontanelles being much opened. Then the child should be stripped, when rickety deformities can be seen, enlarged glands and eruptions be detected, the anus and feet examined for syphilitic eruptions, and the buttocks for itch. The shape of the chest is peculiar in young children, there being a constriction at the upper border of the liver on the right side, and the upper border of the stomach on the left side. The chest is altered in shape chiefly by disease of the spine, by rickets, and by disease of the pleura. The apex of the heart beats rather more to the left than in the adult. Marked signs of lung disease are found at the back, and friction-sounds between the scapulæ are due to disease of the bronchial glands. The belly is big, and this is accounted for by the short pelvis, the large liver, the thin and unresisting abdominal walls, and the fact that the diaphragm is less arched than in the adult. The spleen and kidneys and liver are readily felt, and indeed the abdomen easily examined for disease. The child should now be made to put its arms round the mother's neck; if it be frightened it clings all the closer, and makes tense the back, which can be percussed and auscultated mediately or immediately. The chest is not very resonant, since the walls are flaccid and do not vibrate. A supposed big head is often a trouble to mothers. If the fontanelles are closed, and the child be about two years of age, or they be just open and no cerebral symptoms be present, there is no need for anxiety. In practising percussion, care must be taken not to strike too smartly, the variations in resonance being more readily appreciated by a gentle stroke: it is almost unnecessary to say that mediate percussion must be employed, that is to say, the blow must fall on the finger, not on the chest-walls. One may often gain valuable information from listening to the chest of a child when it is crying, since the forcible inspiratory and expiratory movements cause the air to enter and leave the lungs rapidly, and to expand them fully, so as to bring out various rhonchi and like sounds which might otherwise not be produced if the breathing were tranquil. The child's cry is in this case equivalent in its action to the taking of a "deep breath" in the adult. The respiration is slightly puerile in the child. Lastly, the state of the tongue, the condition of the gums, of the tonsils, and the number of the teeth, if any, remain to be ascertained, it being generally better to examine these last, since, as Dr. West observes, it is usually the most grievous part of your visit to the child. Children cut their teeth as follows: At 7 months the two lower incisors, and complete the others at 10 months. At one year old the first molars appear; at 1½ year the canines; at 2 the last molars; and at 6½ the first permanent molars. There are no bicuspids in children. The fontanelles should be closed at the end of the second year. The disease which retards this in a peculiar manner is rickets. Attention should specially be directed to the state of the nursery, whether it be airy, stuffy, or close, of too cold or too hot a temperature, whether there be endless curtains about the child's bed, and the like. We may now describe more particularly the order in which the notes of cases may be recorded.

SECTION V.

GENERAL MODE OF "TAKING" A CASE.[1]

It has long been a matter of regret that medical practitioners, generally, do not pay greater attention to recording systematic notes of their more important cases. Lord Bacon has well observed, in speaking of the deficiencies of physicians—"The first is the discontinuance of the ancient and serious diligence of Hippocrates, which used to set down a narrative of the special cases of his patients, and how they proceeded, and how they were judged by recovery or death."[2] Such narratives, carefully arranged, not only prove of inestimable value to the practitioner himself, but they forward the progress of the healing art, and especially tend to increase our knowledge of diagnosis and therapeutics.

In taking these notes it is especially necessary to do so methodically. The following plan will probably be found as simple and useful as any:

General Observations.—Name; age, real or apparent; married or single; if a female, number of children and date of last birth; date of coming under treatment; occupation.

Anatomical or Physical Peculiarities.—Development of trunk and limbs; deformities; height; weight; countenance; eruptions on skin, their form and nature; nervous excitability; disposition to sleep; habitual state of bowels; temperament.

Intellectual and Moral Peculiarities.—Education; memory; judgment; reasoning powers; behavior; peculiarities of conversation; vivacity of manner, or nervousness, &c.; disposition; religious feelings, &c.

Previous History.—Place of birth; condition in life, and health of parents; health of brothers and sisters; family diseases; present residence, and how long resident there; occupation; mode of living, appetite, and habits, whether temperate or otherwise; whether a smoker or not; habitual use of medicines and their nature, as narcotics, purgatives, &c.; peculiar habits; alteration of pecuniary circumstances; venereal indulgences.

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[1] The actual symptoms and signs obtained by following this plan will be found in Chapter V.

[2] "Advancement of Learning," book ii. Narrationes medicinales.

Previous General Health.—Habitual health and strength; former illnesses, their nature and duration; liability to colds, coughs, fevers, fits, rheumatism, gout, hemorrhages from nose or mouth, hernia. If a female, age at which catamenia first appeared; nature and duration of the flow; whether regular or otherwise; date of last period; leucorrhœal or other discharges; miscarriages; number of children or abortions; character of labors; suckled her children or not.

Present Illness.—Date and mode of commencement, whether sudden or gradual; probable or assigned causes; excesses; symptoms complained of, with date of accession, and progress of each up to the present time; medical treatment to which patient has been subjected; result of such treatment.

Present Condition.—Aspect and complexion; state of nutrition; state of strength; fever; sensation of cold; shivering; skin harsh and dry, or moist; disposition to be anxious and depressed, or hopeful. (See Section 1, Chapter V.)

Condition of Nervous System.—The form of the skull; the state of the fontanelles in children, whether prominent, depressed, tense, or closed; the hair; tumors, their characters; wounds; scars of old disease; pain of head or giddiness; pain on pressure; pain over any part of spinal column; sensitiveness of any part to pressure or heat, such as a hot sponge; curvatures; impairment of sensibility—ex., vertigo, numbness, tingling, itching, aura, loss of sensation, burnings, neuralgia, or of motion, in face, tongue, sphincters, extremities; decumbency; rigidity; spasm; peculiar movements, jerking, jactitation, gait; muscular irritability; wandering of eyes, state of pupils, squinting; vomiting in children; flushings; paralysis; convulsions and their kind; power of mastication and deglutition; intellect; memory; senses; capacity for mental exertion; sleep, tranquil or disturbed at night; nightmare; dreams, laughter, incoherency, muttering, picking the bed-clothes, delusions, raving, crying; state of organs of special sense; intolerance of light; blindness; flashes of light; double vision; alteration of the hearing, singing in the ears, &c.; deafness; alteration of smell. (See Section 6, Chapter V.)

Condition of Organs of Respiration and Circulation

—Number and character of respirations and pulse; cough, expectoration; voice; pain of chest; decubitus; size and form of chest; relative size of the two sides; examination of the expansive movements of the chest; examination of the lungs by the spirometer, by palpation or the application of the hand, by percussion and auscultation. Phenomena of the circulation; palpitation; percussion and auscultation of the heart; color of complexion; the pulse, and on the two sides; bulgings over the heart; murmurs; point at which the apex is felt; impulse; thrills; rhythm: auscultation of the carotids and other arteries; state of the veins; effect of change of posture on the pulse. (See also Sections 3 and 4, Chapter V.)

Condition of Digestive Organs. — Appearance of mouth, tongue, fauces, tonsils, and pharynx; thirst; appetite; deglutition; nausea or vomiting; hiccup; character of vomited matters; bowels, frequency of defecation and character of evacuations; pain or tenderness of abdomen; results of manual examination; boundaries of liver and spleen; auscultation; tumors; cæcal region, gurgling, tumor, or pain there; hernial protrusions; hemorrhoids; fissures at anus; condylomata. (See also Section 2, Chapter V.)

Condition of Urinary Organs.—Micturition easy, frequent, or otherwise; character of urinary secretion, quantity in twenty-four hours, color, odor, transparency, reaction with litmus and turmeric papers, specific gravity, results of the employment of reagents, nature of pellicle or of deposits—if any; microscopical examination.

Condition of Special Senses.—(For details, see Chapter V.)

Condition of the Generative Organs.—*In the male:* Inguinal canal; state of spermatic cord; the testicle; fluid in the tunica vaginalis; scrotal herniæ; varicocele; discharges from urethra; sores and their aspect; old scars about the penis; enlarged glands in the groin; bubo; stricture; eruptions; masturbation; nature of stream of urine; frequency of micturition; pain. *In the female:* Menstruation, its frequency and character, or suppression; pain; discharges and their character; itching. In the married: the age, how long married, pregnancies, abortions, menses, pains, bearing-down and other; hemorrhages; prolapsus, state of pudendum, vagina, os uteri, from digital examination and the use of the speculum, or the uterine sound, or per rectum; pain over ovaries;

enlargement of ovaries ; pregnancy ; state of mammæ ; nipple ; areola ; enlargement of the breast, &c. ; nursing ; lochia.

Causes of Diseases, probable or assigned.

Diagnosis.

Prognosis.

General Rules of Treatment.—Regimen ; diet ; prescription.

At each subsequent visit the progress of the case must be commented on, the effect of the remedies employed noticed, and at the conclusion the interesting points of the case should be summed up in a few brief remarks.

Should the case terminate fatally, a post-mortem examination must be made in the manner to be now described.

SECTION VI.

MODE OF MAKING A POST-MORTEM EXAMINATION.

At a period varying from twelve to thirty-six, or even —in cold weather—to forty-eight hours after death, the post-mortem examination may be made.

General Observations.—Name ; age ; day and hour of death ; day and hour of examination ; temperature to which the body has been exposed ; degree in which external sexual characters are marked, mammæ, mons veneris, &c. ; state of nutrition ; eruptions ; peculiarities of formation, or deformities ; œdema of face, limbs, or trunk ; marks of violence, contusions, wounds ; degree of rigor mortis ; and the presence or absence of any marks of putrefaction.

Having carefully examined the external appearance of the body,

The Skull is then to be thus opened : Separate the hair, and make an incision through the scalp from one ear across the vertex to the other ; reflect the anterior flap over the face, the posterior over the neck. Then with a saw make a cut through the outer table of the bones of the skull, completely round the cranium, passing the saw anteriorly about an inch above the superciliary arches, posteriorly just below the tubercle of the occipital bone, and on each side on a level with the cartilage of the ear. Introduce the elevator or chisel, and by means of a few smart strokes with the hammer, the inner table will be readily fractured, and the calvarium may be then torn away. The dura mater, the most external of the membranes of the brain, being thus exposed, must be cut through with a scissors on either side—and in the direction of—the superior longitudinal sinus; divide the falx cerebri; and elevating the head by means of a block or tripod, proceed to remove the brain, by gently raising it with the fingers placed under the anterior lobes and olfactory bulbs. The internal carotid artery, and second and third nerves, which first present themselves, are to be divided; the pituitary body to be dislodged from the hollow in the centre of the sphenoid bone; and an incision is to be made through the fourth nerve, and the tentorium cerebelli close to its attachment to the temporal bone. We then successively perceive, and must divide, the two roots of the fifth nerve, the sixth, the seventh with its facial and auditory portions, the three divisions of the eighth — the glosso-pharyngeal, pneumogastric, and spinal accessory—and the ninth nerve. Lastly, we cut across the vertebral arteries as they wind round the upper portion of the spinal cord, and then, as low as possible, divide the cord itself, with the roots of the spinal nerves attached on each side. The brain may now be readily taken from the skull and carefully examined, by slicing it in thin layers in the horizontal direction, from above downwards. The vascularity of the gray and white portions, the quantity of fluid in the ventricles, and the condition of the cerebral arteries must be noticed. To judge of its consistence, a fine stream of water should be poured from a height on the different parts, as they are successively exposed.

In this examination the following points must be noticed: The state of the bones of the head; fractures and their seat; adhesions of calvarium to dura mater; characters of dura mater, arachnoid, and pia mater; Pacchionian glands; quantity and character of the subarachnoid fluid. Weight of brain; weight of cerebrum, pons Varolii, medulla oblongata, and cerebellum. Convolutions of the brain, their appearance and consistence. White and gray substance of hemispheres; consistence — whether natural, increased, diminished—soft, creamy, diffluent; color of cut surface; number and size of red points. Extravasation of blood; situation; quantity. Unnatural cavities in cerebral substance; situation; contents; linings; state of surrounding brain substance. Tubercular, calcareous, or malignant deposits. Lateral ventricles;

contents—color and quantity of fluid; condition of choroid plexus. Third ventricle; contents. Optic thalami and corpora striata. Pons Varolii. Medulla oblongata. Cerebellum; form; firmness; color; appearance on section. Face; lips; cavity of mouth, contents—food or foreign substances; teeth, whether recently fractured; tongue—size, form, papillæ, if stained or corroded. Fauces; tonsils; pharynx; contents of, nature of; œsophagus, dilated or constricted; epiglottis; rima glottidis.

The Spinal Cord is to be exposed by sawing through the arches of the vertebræ on each side, close to the articular processes, after the skin and muscles have been divided down to the bones. In some parts—as in the hollow of the lumbar region—difficulty will be experienced in using the saw; a chisel and hammer will then be found useful. When the spinal canal is opened, the strong tube of the dura mater, prolonged from that lining the skull, will be exposed; this is to be slit up, and the cord examined *in situ*, at the same time observing the quantity of fluid in the spinal canal, and the condition of the spinal veins. Subsequently divide the anterior and posterior roots of the thirty-one spinal nerves, and remove the cord for a closer inspection. The points of importance to notice are the vertebral canal, the theca vertebralis; the size and consistence of the cord, cervical and lumbar enlargements, the state of the gray and white substance; the roots of the nerves, and the cauda equina. The following is Mr. Lockhart Clarke's plan of preparing the brain and spinal cord for microscopical examination: Pieces ½ or ¾ of an inch in size may be steeped in chromic acid solution, 1 part to 200, for three weeks or a month. They are then preserved for use in 1 part of bichromate of potash to 200 of water. In order to harden parts of the brain and cerebellum a weaker solution should be used than that in the case of the spinal cord and medulla, say 1 part to 400 or 500, and the portions of brain must be small, and not more than ½ an inch thick. A knife dipped in spirit of wine should be used to make sections, which are to be washed in water before being placed in the solution of carmine. When sufficiently colored, they are again washed, placed for ten minutes in strong spirit, then floated in spirit of turpentine, to remain until nearly transparent. They may then be removed to glass slides in Canada balsam. The sections are then set aside, and occasionally treated with turpentine to bring out the structure of the cells and fibres, and then mounted in Canada balsam.

The Thoracic and Abdominal Cavities.—For the purpose of examining the morbid appearances presented by the thoracic and abdominal viscera, we open the cavities containing them at the same time, by making a straight incision from the thyroid cartilage of the larynx down to the symphysis pubis. Dividing the integuments, muscles, and peritoneum, we open the abdomen, the contents of which may be more readily exposed by making, in addition, a transverse *subcutaneous* incision on each side, through the fascia, muscles, and peritoneum; then dissecting back the skin and muscles covering the front of the thorax, we expose the cartilages connecting the ribs with the sternum. The cartliages are then to be cut through at their junction with the ribs, except those of the first ribs; and the sternum may now be raised like the lid of a box, a good substitute for a hinge being made by cutting the articulation of the first joint of the sternum on the inside.

In inspecting the trachea and bronchi, they should be opened along their anterior surface. To show the valves of the heart, the right ventricle must be opened by a V-shaped flap, made by an incision immediately to the right of the septum, meeting at the apex another, carried along the right edge of the heart. Before laying open the pulmonary artery, the finger should be introduced so as to guide the incision between the valves. The left ventricle should be opened by an incision in the direction of the aorta, beginning at the apex, a little to the left of the septum, having previously dissected the pulmonary artery off from the aorta, and taking care to use the same precaution against injuring the valves as in opening the pulmonary artery.

In the Examination of the Thorax we should scrutinize and note the state of the trachea; bronchial tubes. Pleuræ; nature and quantity of fluids effused into pleural sacs; adhesions. Lungs; external characters; size; overlapping of the heart or degree of collapse; puckering at any part; cicatrices; emphysema; deposits of tubercle, of cancer; hydrostatic test, whether the lungs sink or float, result with various portions; substance of lungs, consistence, exudation of serum on section; crepitation; abscess; gangrene; pulmonary apoplexy; tubercles, their seat and condition; cavities, their seat, size, form, contents, and if communicating with bronchial tubes; cysts; deposits of cancer. Pericardium; adhesions; white spots, their size, shape, and situation. Heart; its position in the thorax; weight; size; quantity of blood contained in various cavities, and its condition, frothy, liquid, or coagulated; thickness of walls; size of cavities, right auricle and ventricle, left auricle and ventricle; condition of musculi pectinati, columnæ carneæ, chordæ tendineæ; condition of foramen ovale; auriculo-ventricular openings —tricuspid valve, bicuspid or mitral valve; aperture of pulmonary artery, semilunar valves, and corpora Arantii, aortic orifice, valves, and corpora Arantii. Coronary arteries, their condition. Microscopical examination of muscular fibres of heart.

In the Examination of the Abdomen notes should be taken of the peritoneum; its contents; parts through which herniæ have passed. Liver; external characters, form, measurement, weight, color, condition of capsule; substance, cut surface, color, degree of fat, deposits of tubercle, of cancer; cysts; gangrene; microscopical examination. Gall-bladder; size; shape; contents; calculi; ductus communis choledochus. Spleen; position; size; weight; capsule; substance. Pancreas; position; weight; substance; color; duct. Kidneys; external characters; capsule; surface after removal, if lobulated, granulated; cut surface; cortical substance; pyramidal portion; pelvis of kidney; ureters; microscopical examination. Urinary bladder; contents; walls. Stomach; position; size; form; contents; condition of mucous membrane; rugæ; cardiac orifice; pyloric orifice; walls of; cicatrices; ulcers; perforations; wounds. Abnormal condition of intestines generally; cicatrices; ulcers; wounds; perforations. Duodenum; Brunner's glands; ductus communis. Jejunum and ileum; valvulæ conniventes; villi; Peyer's patches; glandulæ solitariæ. Cæcum; appendix vermiformis; ilio-cæcal valve; ilio-colic valve. Colon; glandulæ solitariæ. Rectum; hemorrhoids; prolapsus.

The Urinary and Generative Organs may be readily removed from the body for examination through the pelvis, and if the integuments in the perineum be left uninjured, and the several outlets stitched up, any portion presenting diseased appearances may be taken away without disfiguring the body, and without any of the contents of the abdomen protruding. With regard to the remaining viscera, no special directions seem necessary as to the mode of preparing them for inspection.

In the Examination of Male Organs of Generation we should note the condition of the inguinal canal; vasa deferentia; spermatic cord; tunica vaginalis; testes; penis; prostate gland.

In the Examination of Female Organs of Generation, the state of the labia; nymphæ; clitoris; urethra; hymen; vagina; uterus—lips, size of cavity, thickness of walls; Fallopian tubes; ovaries; pelvic tumors.

The microscopical examination of parts of the different tissues should be made as soon as possible. A little glycerine and water will be found a useful medium. Portions of tissue may be scraped off with a knife, or the sections made with a double-edged blade wetted with water or glycerine.

As it is of course requisite that the details of the morbid appearance should be strictly accurate, the notes should be taken at the time of making the autopsy.

SECTION VII.

THE CLINICAL EXAMINATION OF THE INSANE.

The clinical examination of a man supposed to be insane differs very materially from that adopted in the diagnosis of corporeal diseases. To inquire of a lunatic of what he complains—or where he suffers pain—or how long he has been ill?—is in the majority of cases useless; since he will only reply that he has no pain, that he is quite well, and that he wishes to know by what authority you venture to question him. Neither does the appearance of the tongue, the nature of the pulse, nor the character of the secretions afford us any valuable indications; but we are obliged to rely upon the information gained from a close examination of the physiognomy, actions, conversation, powers of judgment, and memory, &c. The state of the general health is, however, by no means to be neglected, since, as is well known, the body affects but too closely the state of the mental faculties: want of vitality and of nervous tone, deficient healthy action of the skin and internal organs, and torpidity of the primæ viæ, are moreover, exceedingly common in the insane.

The various varieties of unsound mind may be thus classified: (1.) Amentia, including Idiocy and Imbecility. (2.) Dementia. (3.) Mania, general or partial, moral and intellectual; and (4.) Monomania.

Now, idiocy and imbecility are allied. In both there is original deficiency of intellect. The subject of idiocy is born totally devoid of understanding, and has no lucid intervals. The imbecile, although not absolutely insane, is yet unable "to guard himself against imposition, or to resist importunity or undue influence." The idiot, moreover, cannot be taught to speak. Imbeciles can. As Dr. Guy puts it, the idiot is an imperfectly-developed being, with a mere animal existence, obedient to the simplest calls and impulses of nature, dependent on others for support, and able at the best to utter a few meaningless articulate sounds. The imbeciles, on the other hand, have a certain amount of intelligence, understand what is said to them, and make themselves understood, remember common events, form habits of decency and propriety, and are equal to common household occupations, or to trades easily acquired. Some others can be more improved than this, but their moral perceptions are not of a high order, and hence they go to form some part of the criminal population. Those in a better position, played upon by the peculiar influences that surround them, are extravagant and often intemperate. The imbecility may be general or partial, that is mainly moral or intellectual. Cretins are imbeciles. In imbeciles there is more or less arrest of brain development or deformity. Idiots are wholly irresponsible.

We now come to acquired insanity, and first have to notice—

Dementia.—This is imbecility, the result of acute diseases, shock, injury to the head, or old age, and it may be conjoined to epilepsy, paralytic attacks. This form of insanity is often seen in those who in early life exhibit weakness of will, or of moral self-control. The dementia of old age is called Senile Dementia. General paralysis is sometimes associated with dementia.

Mania, as before observed, may be of various kinds. It is always accompanied by excitement. *General* mania we notice in what is termed the raving lunatic. All the mental processes are distorted; the patient is violent, passionate, and restless. Sometimes the *intellectual* processes are generally perverted. At other times the mind is partially deranged in one direction only; then we have monomania. Lastly, we have *moral* mania, which is "a morbid perversion of the natural feelings, affections, inclinations, temper, habits, and moral dispositions, without any notable lesion of the intellect or knowing and reasoning faculties, and particularly without any maniacal hallucination." An instance of general moral mania is afforded by the well-known case of Frederick William of Prussia, whose intellectual acquirements were good, whose moral behavior so strange. In the partial form of moral mania, some one moral faculty becomes disordered, whilst the "intellect and conscience remain intact, leading to struggles of which it is impossible to exaggerate the misery." The various forms of this mania, such as kleptomania, dipsomania, suicidal and homicidal monomania, pyromania, nymphomania, &c., are well known.

The difficulties experienced in the diagnosis of insanity will, of course, depend upon the degree in which the mental faculties are lost. The majority of insane people—especially in chronic cases—are able by a greater or less degree of exertion to restrain their insane impulses on occasions, and they do so. Consequently, we must draw our conclusions not merely from the evidence derived from the nature of the countenance, or of the actions, or of the conversation, but from our entire—and, if necessary, frequent and unsuspected—examination of the patient.

Investigation of the Physiognomy.—To appreciate correctly the inferences to be drawn from this examination, the eye must be practised by long-continued observation not only of the insane, but of the varieties of expression which indicate the growth, normal state, and decline of mental vigor. We should be familiar with the cheerful, open countenance of the man in the enjoyment of mental and bodily health and ease, with the vacant stare of the thoughtless, the melancholy visage of the disappointed, the dreamy look of the absent man, and with the wildness of the expression of the maniac; we shall then be able justly to estimate the evidence written upon the forehead, the expressive language spoken by the eyes—the mirror of the mind, and the inward restlessness betokened by the constant play of the muscles around the mouth.

Investigation of the Actions.—From examining the face, we shall proceed naturally to observe the attitudes, gestures, movements, and general conduct. The facility, suppleness, and co-ordination of the movements must be noticed. The attitude of the old man with his head inclined to his chest, his back bent, and his knees giving way under him, is not more characteristic of a state of senility and exhaustion, than is the position of an unfortunate human being seated on the floor, with his chin resting on his knees, motionless for hours, and entirely unmindful of all that is passing around, indicative of incurable dementia. The gestures alone often indicate the passion which predominates. In insanity from disappointed love, airs of languor are often affected; in that from religion, great humility and attention; in that from sexual excesses, a downcast appearance, an evident desire to avoid notice, and an inability to look one in the face. The various gestures and actions of the insane, however, from the happy, easy movements of the man who believes himself a monarch, or the excited, violent ravings of one suffering from acute mania, to the sad, torpid listlessness of the incurably demented, require to be drawn in stronger colors than we have the art of employing, in order to produce truthful portraits.

The Conversation of the Insane.—In endeavoring to gain information from this source, we must first seek to obtain, by kindness and a sympathizing manner, the confidence of the patient; for since it will frequently be necessary to ascertain his thoughts on the most varied subjects, so—unless we do so—and succeed in interesting him, he will often become suspicious of our motives, sullen, and uncommunicative. Lord Erskine, in his defence of Hadfield, referred to the case of a lunatic from whom he could draw no indication of insanity in the course of an examination in a court of law, until Dr. Sims entered, when the man addressed him as the Lord and Saviour of mankind. In many cases of madness, the reasoning faculties not being wholly lost, we are not surprised at finding that the patient can discuss correctly on many topics, until some accidental observation leads him to break out into the most imbecile extravagance, or makes him confide to us plans of revenge, or proposals for performing the most impracticable achievements.

The Memory of the Insane.—Evidence may generally be obtained more easily upon this point than upon most others. A few quiet questions addressed to the patient as to his name, age, and address, the members of his family, the nature of his occupation, the day of the week, the name of the reigning monarch, &c., will often suffice, or where there is evidently mental weakness, we may ask him to shut his left eye, give his left hand, put out his tongue, show his right leg, and so on. An examination of the letters written by such a one will often also give us information upon this head, while they at the same time teach us his intimate thoughts. These letters are often rambling and incoherent, and a very frequent characteristic of them is that they are full of wants.

In connection with this subject it remains to say that the practitioner should, as a rule, be introduced to the patient in his proper character, and that he should bear in mind that the object of his examination is not only to determine whether the individual is of unsound mind, but if so, the treatment that must be adopted, especially with reference to the necessity for restraint, and the degree to which it may be called for. Should the circumstances require him to give—

A Certificate of Insanity, he must remember the stringent rules with respect to it, enforced by the Act of Parliament, which came into operation on the 4th of August, 1845. According to Section 45, no person (not a pauper) can be received into or detained in any licensed house or asylum, without an order from some responsible person, and two medical certificates, which must be signed by two physicians, surgeons, or apothecaries, not in partnership, and having no interest directly or indirectly in the house or hospital in which the patient is to be confined. They must each separately examine the alleged lunatic, not more than seven days prior to his reception into the asylum; and they must severally sign and date the certificate on the day of examination, and state the facts on which they form their opinion. The following are the directions of the Lunacy Commissioners with reference to these lunacy certificates.

INSTRUCTIONS.

Every medical certificate must, in order to its validity, be according to the subjoined Form, prescribed by the "Lunatics' Care and Treatment" and "Lunatic Asylum" Acts, 1853.

In filling up the Certificate, the Medical Practitioner signing is requested especially to observe the following *essential* particulars, viz.:

1. After the words "being a," he is required to insert not the word "Physician," "Surgeon," or "Apothecary,"

but the legal Qualification, Diploma, or License entitling him to practise as such within the United Kingdom.

The words of the Interpretation Clause are as follows: "'Physician,' 'Surgeon,' or 'Apothecary,' shall respectively mean a Physician, Surgeon, or Apothecary, duly authorized or licensed to practise as such by, or as a Member of some College, University, Company, or Institution legally established and qualified to grant such authority or license in some part of the United Kingdom, or having been in practice as an Apothecary in England or Wales on or before the 15th day of August, 1815, and being in actual practice as a Physician, Surgeon, or Apothecary."

2. He is required to insert: 1. The Date of examination. 2. The Place, with "*the Street and Number of the House* (*if any*) *or other like particulars*," where the Patient was examined. 3. The Patient's ordinary Place of Residence. 4. The Patient's Profession or Occupation, if any.

3. In any case where more than one Medical Certificate is required by the Act, he should insert before the words "personally examined," the words "separately from any other Medical Practitioner."

4. He is required, in order that his Certificate may have any validity in law, to set forth some fact or facts, or symptoms, indicating Insanity, *observed by himself.*

5. The Certificate need not be drawn up or dated on the day of examination, but the Patient *must be examined within seven clear days prior to admission.*

6. Every Certificate should be an independent and complete document, and no reference should be made therein to another.

NOTE.—Medical Officers of Unions or Parishes are no longer prohibited from signing Certificates in the cases of Pauper Lunatics belonging thereto.

FORM OF MEDICAL CERTIFICATE.

I, the undersigned, [*here set forth the Qualification entitling the Person certifying to practise as a Physician, Surgeon, or Apothecary, ex. gra.*, "being a Fellow of the Royal College of Physicians in London,"] and being in actual practice as a [Physician, Surgeon, *or* Apothecary, *as the case may be*] hereby certify, That I, on the
at [*here insert the Street and Number of the House* (*if any*) *or other like particulars*] in the County of

[*in any case where more than One Medical Certificate is required by this Act, here insert* separately from any other Medical Practitioner,] personally examined *A. B.* of , [*insert Residence and Profession or Occupation*, if any], and that the said *A. B.* is a [Lunatic *or* an Idiot *or* a Person of unsound Mind], and a proper Person to be taken charge of, and detained under Care and Treatment, and that I have formed this opinion upon the following grounds, viz.:

1. Facts indicating Insanity observed by myself [*here state the Facts*].

2. Other Facts (if any) indicating Insanity communicated to me by others [*here state the Information, and from whom*].

(Signed,)
Place of Abode.

Dated this day of , One thousand eight hundred and .

This form is used for "Private Patients," to whom a special set of instructions, to be noticed presently, apply.

Medical Case-Book.—In the Act of Parliament before referred to, a section has been introduced requiring that a medical case-book shall be kept in every asylum throughout the kingdom, in which the history, treatment, &c., of all patients shall be from time to time recorded. Special Forms of all kinds may be obtained through the office of the Lunacy Commissioners.

Private Patients.—Much ignorance and carelessness has been exhibited of late by medical men and others in reference to the reception of persons of unsound mind into their hands as inmates, and the Commissioners have thought it well to issue a memorandum, addressed "To all persons having charge of single insane patients." It is as follows:

The Law relating to Single Insane Patients, and defining the duties and responsibilities of those who undertake to receive such Patients to reside with them, being in general very imperfectly understood, and frequently violated, attention is urgently requested to the subjoined Statement of the various provisions of the Statutes, which the Commissioners intend, in future, most strictly to enforce.

PROVISIONS OF THE LAW AS TO SINGLE PATIENTS.

Order and Certificates.—No person deriving profit from the charge, can receive into any house, or take care or charge of, a Patient as a Lunatic, or alleged Lunatic, without an order and two Medical Certificates.

Copies, &c., to be sent to Commissioners.—Within one clear day after receiving a Patient, true copies of the order and certificates, together with a statement of the date of reception, and of the situation and designation of the house into which the Patient has been received, as well as of the Christian and Surname of the owner or occupier thereof, must be forwarded to the Office of the Commissioners in Lunacy, No. 19 Whitehall Place, London, S.W.

Statement.—In addition to these documents, there must now be forwarded to the Office of the Commissioners a statement of the condition of the Patient, signed by his medical attendant, after two clear days, and before the expiration of seven clear days from the day of reception, according to the form in Schedule F. to chapter 100.

Persons disqualified from signing.—The order and certificates must not be signed by any person receiving any percentage on or otherwise interested in the payments for the patient, nor by the medical attendant as defined by the Lunacy Act, chapter 100; nor must the certificates be signed by the father, brother, son, partner, or assistant of the person having the care or charge of the Patient.

Fortnightly Visits.—The Patient must be visited, at least once in two weeks, by a Physician, Surgeon, or Apothecary, who did not sign either of the certificates of insanity, and who derives no profit, and who is not a partner, father, son, or brother of any person deriving profit from the care or charge of the Patient.

Entries.—Such medical man must, at each visit, enter in a book to be kept at the house, *according to the subjoined Form*, and to be called the "Medical Visitation Book," a statement of the condition of the Patient's health, both mental and bodily, and also of the condition of the house.

Less frequent Visits.—These visits may, by special permission of the Commissioners in Lunacy, be made less frequently than once in every two weeks; but in such case, where the Patient is under the care or charge of a medical man, such medical man must himself make an entry once at the least in every two weeks in a book to be called the "Medical Journal."

Annual Reports.—Every Physician, Surgeon, or Apothecary, who visits a single Patient, or under whose care a single Patient may be, must, on the 10th of January, or within seven days thereof, in every year, report in writing to the Commissioners the state of health, mental and bodily, of the Patient, and such other circumstances as he may deem necessary to be communicated.

"*Medical Visitation Book*," *&c.*—"The Medical Visitation Book" and "Medical Journal," and the order and certificates must be so kept that they may be accessible to the Commissioners whenever they may visit the Patient.

Notices.—Notice must be forwarded to the Office of the Commissioners in case of the death, discharge, removal, escape and recapture of a Patient; and in case of removal, the exact address and designation of the house must be specified.

Notice to Coroner.—Notice of the death of the Patient must also be forwarded to the Coroner of the District.

Transfers.—If the Patient is proposed to be removed to the care or charge of another person, consent to an order of transfer must previously be obtained from the Commissioners, otherwise a fresh order and certificates will be necessary.

Changes of Residence.—When any person, having the care of a single Patient proposes to change his residence, and remove the Patient to such new residence, seven clear days' notice of the proposed change must be sent to the Commissioners, and also to the person who signed the order for reception of the Patient.

Removals for Health.—If it should be desired to give the Patient liberty of absence anywhere, for a definite time, for improvement of his health, or for a trial of his powers of self-control, the consent of the Commissioners must first be obtained.

Penalties for Neglect or Violation of the Law.—The attention of every person having charge of a single Patient, is specially drawn to the concluding paragraphs of the 90th section of the 8 and 9 Vict. cap. 100, by which he will see, that if he shall receive a Patient without a proper order, and certificates, or if, having such certificates, he neglect to transmit copies to the Commissioners in Lunacy, or if he fail to cause such Patient to be visited fortnightly by a medical man (not disqualified as above), or if he make any untrue entry in the "Medical Visitation Book," he shall be guilty of a misdemeanor.

Form of Medical Visitation Book or Medical Journal.

Date.	Mental State and Progress.	Bodily Health and Condition.	Restraint or Seclusion since last entry. When, and how long? By what means, and for what reasons.	Visits of Friends.	State of House, Bed and Bedding, &c.

SECTION VIII.

EXAMINATION OF PERSONS FOR LIFE ASSURANCE.

The knowledge required by a medical man in "the life office" is somewhat different from that necessary in the private consulting-room. In the latter the patient is full of complaints, anxious to acknowledge all the pains and symptoms of disease which he may be suffering from, and ready to communicate the cause and history of his malady; in the former he generally acknowledges no uneasiness, and does his best to appear constitutionally strong and free from disease. In the consulting-room no information is withheld, and it is only necessary for the practitioner to weigh the value of the evidence laid before him, reject that which is worthless, and act upon that which is to be relied on; in the assurance office the tendency is to withhold and keep back everything which the assurer may deem calculated to make his life appear bad. The duty of the medical officer, consequently, resolves itself into looking out for and detecting any hidden diseases, malformations, or conditions which may threaten to shorten or endanger life; as well as to observe upon the effects of any previous disorders which may have tended to vitiate the constitution.

There are some offices which insure lives of doubtful or positively unsound character, and in these cases the closest criticism is needed. In addition, the medical practitioner is often required to report on the lives of those who enter various mutual provident societies, or the condition of those who have received injuries against which an insurance had been effected.

It not unfrequently happens that a medical man is called upon to report on the life of his own patient or friend. He must do so with rigorous impartiality. His friendly relations must cease to influence him.

The points to which the medical man should chiefly direct his attention are these:

1. The age, apparent age, occupation—and exposures attending it—and general appearance of the client.
2. The family history, especially as regards the existence of scrofula, phthisis, insanity, gout, apoplexy, epilepsy, and renal diseases, occurring either in father, mother, brothers, or sisters. The causes of death in near relations, and the ages of the latter at death.
3. Illnesses gone through since childhood, especially

as regards small-pox and vaccination, gout, rheumatism, as pointing to heart disease, spitting of blood in relation to consumption, asthma as tending to induce lung and heart disease, pulmonary complaints, and fits of any kind as evidencing disease of the brain; lastly, rupture or stone.

4. The general habits and mode of living, inquiring as to the employment of exercise, early hours, and the use of intoxicating drinks, opium-eating, &c.

5. The character of the pulse and respirations.

6. The height, weight, and vital capacity—as ascertained by the spirometer.

When an examination has been made in the above order, the practitioner must proceed or not to make further investigations as he may deem necessary, and in the manner his judgment will suggest. In deciding upon a life, the recollection of the following aphorisms may lead to a correct decision.

If in doubt about the propriety of accepting a certain life, consider whether it would be advisable for the office to have one hundred such cases on its books.

If there be nothing special in the family history, no consumption, if the client be well formed, temperate, leading a regular life, if he have a good steady pulse of 70 to 80, and his lungs be apparently sound, no doubt need be entertained about the admitting of such a life.

Paucity of evidence in the family history must lead to increased care in the personal examination of the applicant.

Decline the life of a person who is not sober. Suppose he has been given to drinking, and has reformed two or three years, yet his life should be declined, since permanent reformation is so very rare.

Tavern-keepers and such like must be most carefully examined. As a rule their lives must be declined, unless the most overwhelming proof of temperate habits be forthcoming. The reformed drunkard's is not a good life.

Persons who are in *any* degree intemperate, should be closely scrutinized and their lives cautiously accepted.

When there is consumption in the parents, decline the case.

The parents being well, but two or three of the brothers or sisters having died from phthisis, the life may be accepted, provided the applicant be strong and healthy, of proper weight and vital capacity, and of good habits.

Some offices, however, now make a rule of declining under these circumstances. Should there be any flaw in the weight or vital capacity, decline.

If a man has had distinct hæmoptysis, decline.

If a woman has had hæmoptysis, especially in early life, we may accept after a careful examination.

If a man or woman be above the normal weight, and the weight be rapidly increasing, decline; since such a person is quickly making fat, and may convert tissues whose integrity is necessary to life into the same material; especially in such is there a tendency to apoplexy, fatty degeneration of the arteries of the brain being often a cause of this disease. Look with suspicion upon an applicant who has fatty degeneration of the margin of the cornea (arcus senilis), since a similar change may be taking place in the muscular fibres of the heart, or in the cerebral vessels.

Where there is any hereditary tendency to insanity, be very careful in the examination; if the life be accepted, it should only be at an increased premium.

It is almost unnecessary to add, in conclusion, that an epileptic, or one who has had a fit of apoplexy—however slight, or one affected with paralysis—however partial, can never be accepted.

There are many cases in which the life cannot be accepted as sound, nor indeed fairly rejected *in toto*. In this case the life is accepted by the payment of an additional premium. Each case must be judged on its merits. The following influences are amongst the most important that suggest the imposition of a high rate of premium. Residence in an unhealthy and damp locality, in tropical climates. Sedentary occupation, excessive luxury, continual exposure to the roughest weather. Work at night in hot rooms, habitual deficiency of natural sleep, occupations in which metallic compounds are handled from day to day. The existence of consumption in branches of the family somewhat distant. Acute rheumatism and lung disease in early life.

The death of parents at an early age and the removal to India.

It is almost unnecessary to caution against the mistaking of nervousness and its effects on the pulse and heart, for disease. A little breathing-time given to the patient, whilst his attention is directed to some other topic than the examination, will soon be followed by a lowering of the pulse and a diminished frequency in the beats of the heart.

SECTION IX.

ON MEDICO-LEGAL INVESTIGATIONS.

In addition to the duties which every medical man owes to the public individually in his capacity as a practitioner, there are no less important obligations due from him to society at large. He is often called upon not only to save life when it has been threatened by violence, the use of poisons, &c., but also to give evidence in courts of law touching such cases, in order that crimes against the person may be discouraged by the detection and punishment of those who practise them.

Another set of cases sometimes come before the courts of law in which the medical evidence is of the most important and difficult character—viz., in actions for damages for injuries received in railway accidents.

There is a gradually growing disposition to the more extensive employment of medical experts in courts of law.

These experts are called to pass an opinion on the facts as elicited at the trial. The practitioner is generally required to state what the medical facts are. He should state facts and not opinions, unless required to do so, and then he should limit himself to an interpretation of the facts to which he testifies, and not enter into any general remarks on the case. He should use the plainest possible language, avoid technicalities if he can, and not drag in the views of authorities. He has to speak of matters within his own personal knowledge.

Use of Notes.—In the examination of cases, it is advisable that notes be made at the time of observation of the particulars, whether they appear important or not, noting the time at which the person was first seen, the hour, day of the week, and day of the month being invariably mentioned, the period of the occurrence of death, as well as the circumstances under which the practitioner was summoned. The words yesterday, next day, and similar vague expressions, should never be employed in such records, as they cause great inconvenience if referred to at a trial, and render a reference to almanacs necessary. It is also indispensably necessary that the notes should be taken on the spot at the time the observations are made, or as soon afterwards as possible, otherwise they are not admissible as evidence. There is another rule which it is essential to remember. The notes may have been made on the spot in the manner required by law; but when a witness is about to refer to them in a court of justice, he will often be asked whether he is using them for the purpose of refreshing his memory, or whether he is about to speak only from what is written on the paper, without having any precise recollection on the subject. If for the latter purpose, the evidence is inadmissible, for it has been held by our judges that notes can only be used in evidence for the purpose of refreshing the memory on a fact indistinctly remembered; they are, in other words, allowed to assist recollection, not to convey information.

If the notes of any cases be written at the dictation of the practitioner, they should be carefully read over afterwards and corrected so that they may be sworn to as true.

Confessions and Death-bed Declarations.—A culprit may make a confession of guilt to his medical attendant, and it is well that it should be known, that to be admissible in a court of law, it must be free and voluntary, uninfluenced by threat, promise, or inducement. The medical man, then, if asked to receive a confession, must hold out no sort of inducement to make it. He should put no leading questions and make no comments, but should reduce the statement to writing as soon as possible, read it over to the person confessing, obtain his signature to it, and countersign it himself.[1] The same rules apply to all death-bed declarations, in homicidal cases, which, it must be remembered, will only be subsequently admissible as legal evidence when the parties making them were satisfied that recovery was impossible. Evidence may be given, however, to show that the declarator was the subject of unsoundness of mind at the time of declaration, or was unduly influenced by revengeful or other feelings.

Reports for Judicial Purposes.—In drawing up a report of the symptoms, post-mortem appearances, and results of a chemical analysis, the facts should be in the first instance plainly stated in language free from technical terms, and easily intelligible to non-professional persons, any display of erudition being misplaced. In recording facts, also, a reporter should not encumber his statements with opinions and inferences, but should reserve his conclusions until the end of the report. The language in which these conclusions are couched must be precise and clear, and should form a concise summary of the whole report, upon which the judgment of a magistrate or the decision of a coroner's jury may be ultimately based. Reports should be strictly kept to the matters under inquiry, and ought commonly to refer to the following questions: What was the cause of death? What are the medical circumstances leading to a supposition that death was not due to natural disease? What are the circumstances leading to a supposition that death was caused by violence, by poisons? &c. It must be remembered, also, that the conclusions are to be founded only upon medical facts, and upon what the reporter has himself seen; a conclusion based upon mere probabilities is of no value as evidence.

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[1] See Dr. Guy's "Forensic Medicine."

In performing a post-mortem examination, a note must be made of the time after death at which it is made. The external appearances of the body are to be then observed, noting whether the surface be livid or pallid, the state of the countenance, and the presence or absence of marks of violence on the person both on back and front; also, whether the rigor mortis has gone off, as well as the presence or absence of warmth in the extremities, or in the abdomen, as giving a clue to the time which has elapsed since death took place; the vagina, anus, the mouth, and air-passages should be examined for injuries or foreign bodies. The state of all the internal organs must then be remarked, especially the condition of the abdominal viscera. If the stomach and intestines be found inflamed, the seat of inflammation should be exactly specified; also all marks of softening, ulceration, effusion of blood, corrosion, or perforation. . The stomach must be removed and placed in a separate vessel, with its contents, a ligature being previously applied to the cardiac and pyloric orifices. The state of the thoracic viscera, of the brain, and of the spinal marrow, as well as of the genital organs, should be examined.

Occasionally the inspection is required to be made some time after interment. So long as the coffin remains entire the expectation of discovering certain kinds of mineral poison in particular organs may be entertained; although decomposition may have advanced so as to destroy all pathological evidence. The inspection in such cases is commonly confined to the abdominal viscera, especially to the stomach, liver, and spleen, which should be taken from the body, and immediately sealed up in clean glass or porcelain vessels, and so kept for analysis.

In drawing up a report on the results of a chemical analysis, the following rules should be borne in mind: 1st. When, how, and from whom, the liquid or solid reserved for analysis was received; its state, whether secured in any way or exposed; whether labelled or not; and the kind of vessel containing it. 2d. Where and when the analysis was made; whether with or without the assistance of a second person; and where the substance was kept during the intermediate period. 3d. The physical characters of the substance; the processes and tests employed for determining whether it contained poison, not detailing all the steps, but giving a general outline of the analysis; together with the strength of the poison, the quantity present, and whether it could be produced or exist naturally within the body. And 4th. What quantity of the poison discovered would suffice to destroy life; and to what extent the dose might be modified by age or disease.

There are but few reports in which answers to these questions will not be required; and unless the whole of them be borne in mind at the time an analysis is undertaken, those which are then omitted can never be subsequently answered with satisfaction. The results of analysis, in the shape of sublimates or precipitates, should be preserved, as evidence, in small glass tubes hermetically sealed and labelled, so that they may be produced at the inquest or trial.

In many medico-legal inquiries, we shall derive invaluable assistance from the use of the microscope, as in diagnozing blood-stains from discolorations produced by red fluids, human hair from that of animals, as well as in discovering spermatozoa in cases of rape. Should we resort to the employment of this instrument, drawings must be made—by the aid of the camera lucida—of the appearances found.

Medical Evidence at Inquests.—In giving evidence before the coroner, the medical man should be as careful as if in one of the superior law courts; it being necessary to remember that all he says is taken down by the coroner, and that if the case be sent for trial, such depositions will be in the hands of both judge and counsel. Should there subsequently be any discrepancy in the practitioner's evidence, he will subject himself to severe censure.

It would be quite impossible to enter into any description of the details of medico-legal investigations. The reader should consult Dr. Guy's "Forensic Medicine" for an admirable account of them.

Medical Evidence in Cases of Shock to the Nervous System resulting from Railway Accidents.—The medical practitioner is frequently consulted respecting injuries alleged to have been sustained by a patient in a collision upon a railway, and these cases are very important, from their becoming so often the ground of an action at law against the company. The difficulty of giving anything like a useful epitome of the character of these injuries is great, from the exceeding diversity of importance which attends them. Seeing that it happens that every now and then a passenger is killed by such an accident and that in the same train there may be others who receive a very slight shock, it is reasonable to conclude, as is indeed doubtless the case, that between these extremes there lie instances of varying degrees of injury sustained by the same act of violence. Anything like a dogmatic statement of the probabilities attendant upon an injury so sustained would be useless, considering, as we are bound to do, besides, that the patient's idiosyncrasy will have very much to do with the severity or trifling character of the results to be expected. We may profitably direct the attention of our readers for detailed information, which we of course cannot give, to some valuable papers which have been contributed on this subject by Dr. Buzzard (*Lancet*, March 30, 1867, et seq.), in the first of which there is a very careful consideration of the *dynamics* of railway collisions, which should be studied by every one who finds himself involved in a case of this kind. Dr. Buzzard has been kind enough, at our request, to give us a few notes upon the subject, which, as they are derived from a large experience, will probably furnish useful hints to our readers. We subjoin his remarks :

"In forming an opinion upon the gravity of the symptoms described by a person who has been in a railway collision, the first point to be considered is his credibility. There is a very great temptation to deceive in such cases. Heavy damages there can be no doubt have frequently been awarded when there has been nothing to depend upon save the *ipse dixit* of the alleged sufferer. These cases are reported in the journals, and but few persons are unacquainted with the train of symptoms described, so that there is a liability for the patient to experience in his own case what others similarly circumstanced have felt.

"It is very easy for a person to complain of shattered nerves, inability to sleep, deep-seated pains, defective memory, weakness of sight, and various anomalous sensations, and very difficult for the practitioner to judge whether they exist except in the patient's imagination. A great deal can be done by careful inquiry and observation, and it is not safe to base an opinion upon assertions which have not been confirmed by investigation of this kind. Where there are *objective* symptoms—where, that is to say, something or other can be perceived for himself by the practitioner, whether it be the occurrence of convulsions, local paralysis, alteration of the frequency of the pulse or the natural temperature of the body as indicated by the thermometer, or alteration of size of limbs as shown by the measuring tape, or changes in the retina as seen by the ophthalmoscope—the diagnosis is comparatively easy. Still in such cases there is one point which must be borne in mind. Constitutional syphilis will simulate many of the symptoms supposed to be due to violence; and it is very often a matter of extreme perplexity to decide how much may be due to either of these causes. Careful inquiry should always be instituted upon this point, and the opinion should be very guarded where, without any sign of blow upon the head, such symptoms as paralysis of one or other of the cranial nerves is evident. There is no doubt that a great many kinds of disease of the nervous system may be due to violence. I have myself seen, in hospital practice, numerous cases of epilepsy, some of general tremor, progressive muscular atrophy, general spinal paralysis, and a few of progressive locomotor ataxy, which seemed clearly referable to such a cause. But, at the same time, it is to be noted and remembered as a very important fact, that but few cases exhibiting the anomalous nervous symptoms so often described in courts of law are to be found amongst hospital patients who have received violence closely resembling that resulting from railway collisions. My experience would lead me to believe that, as a general rule, the nervous shock (where it is not complicated by objective phenomena) thus occasioned is a remedial evil—that after a few months, especially when litigation has ceased, repair takes place and the patient eventually is little or nothing the worse for his injury. On the whole the prognosis (and this is the point of importance to the practitioner who has to give evidence) is favorable in cases where the symptoms are entirely subjective. It is in these cases that the chief difficulty occurs. In those presenting objective symptoms there is much less difficulty in forming a conclusion. They must be tried by the test of ordinary experience in lesions of a corresponding kind. It is a fact, that any exhaustion of the nervous system, whether induced by emotion, excesses, business cares, or anxiety about reputation where this in endangered, will produce symptoms precisely resembling those induced by a mechanical shock to the nervous system, and it is in the experience of most medical men that, as a rule, such cases do well. And in judging of the probability in a particular case it should not be forgotten that what is called 'nerve' does not improve as life goes on. The man who can coolly face a five-barred gate at thirty, even though he sustains no mechanical or emotional shock, will yet find that as years come over him he loses a considerable part of his *sang froid;* and it would be very hard for railway companies to be mulcted in respect of this deficiency, which is a natural condition of man's nature. On the other hand there can be no doubt that cases occur in which a very marked change, dating immediately from an accident, points indubitably to a permanent injury sustained by that cause, and in such a case it would be an injustice that the sufferer should not receive all the compensation (and it is a poor one) which damages at law will confer. I think that in approaching any railway case the only fair way is to begin with a certain amount of doubt, to remember the numerous sources of fallacy, to test the patient in every possible way, and to arrive at a conclusion only after a very careful consideration of all the circumstances connected with the case.

"I have described in the first number of the *Lancet* for 1869, a contrivance by which I tested, in a doubtful case, the genuineness of alleged complete anæsthesia of one side of the body, the result affording sufficient proof that the symptom, as the test showed, was not assumed.

Some such contrivance as this may be found useful in similar cases, which are perhaps of all the most difficult to decide. There are certain sources of fallacy which it is very important to remember. I know of one railway case in which much importance was attached to a great dilatation of the sufferer's pupils, until it was accidenttally discovered that the phenomenon was due to the influence of a belladonna plaster which had been applied to the back for local pain, without, it may be added, any intention to deceive. I myself met with a case of similar kind not long since, where belladonna had been given internally with a similar result. In testing alleged loss of power in the limbs of one side of the body it is useful, where there is suspicion of deception, to examine the patient whilst lying on his face as well as his back. The examiner remaining in one spot, say on the side of the alleged paralysis, the patient is apt to forget that when the position of the body is reversed it is on the side which is now *away* from the examiner that the symptoms should be exhibited, and he may therefore continue to feign them in the limbs nearest to the examiner. Those again who simulate anæsthesia are apt to represent it as affecting portions of the body in which from the distribution of the nerves it would be unlikely or even impossible, and a consideration of the nerve-supply may decide conclusively a doubtful case. It has sometimes happened that undue discredit has been thrown upon a case from paralysis being described as affecting the limbs of the same side of the body as that on which a blow was received upon the head. It has been argued that, owing to the decussation of motor fibres in the upper part of the cord, this was impossible. But it must be remembered that a blow, on the right parietal eminence, for example, may cause effusion of blood by contre-coup at the lower part of the *left* cerebral hemisphere, giving rise, by the compression produced, to paralysis of the *right* limbs. Such are some of the many points to be borne in mind in the investigation of these very difficult cases, which, without very careful examination, are apt to lead to great injustice being inflicted upon a *bonâ fide* sufferer, or to fraud upon the railway company against whom a fanciful person or an impostor brings an action."

Vaccination Obligations.—As vaccination has been now made compulsory, under certain penalties, it may be useful to define the obligation of medical practitioners.

Parents often request information from medical men as to the mode of procedure which they must adopt. When the birth of a child is registered, a notice is delivered to the parent or other person having custody of the child, requiring the operation of vaccination to be performed, and specifying the time and place of attendance of the public vaccinator of the district. The parent is bound to take the child to the public vaccinator or a medical practitioner within three months of its birth, to be vaccinated ; but if the child is thought to be in an unfit state for the operation, a certificate to this effect may be given to the parent, and it will hold good for two months, when it may be renewed. If the child be in a fit state it will be vaccinated, then it must be brought at the end of a week to be inspected, and to be re-vaccinated if the operation do not succeed. If the operation succeed, and be performed by a public vaccinator, a certificate of successful vaccination must be sent by him to the Registrar, and a duplicate given to the parents within 21 days. When the operation has been performed by a medical practitioner, not a public officer, the certificate of successful vaccination is to be given to the parent, who is responsible for its transmission to the Registrar of the district. At the end of every half year defaulters are liable to conviction and the imposition of a penalty not exceeding twenty shillings. The private practitioner who has vaccinated a case and refuses to give a certificate when the operation is successful is liable to the same penalty.

CHAPTER II.

ON THE INSTRUMENTS EMPLOYED IN THE DIAGNOSIS OF DISEASE.

SECTION I.

THE MICROSCOPE.

THE microscope[1] is an instrument of paramount importance to the medical practitioner of the present day. It is quite unnecessary to point out the aid which it renders the physician in the diagnosis of internal as well as external disorders.

The chief obstacle to the more frequent use of the microscope has been found in its expense; but now a cheap and serviceable instrument may be obtained for six and eight pounds from many makers (Pillischer, Highley, Collins, Ladd, How, Baker, Crouch, Norman, Murray and Heath, Powell and Lealand, Ross, Wheeler, Smith and Beck, and Salmon) under the name of *the student's* or "*clinical*" *microscope*, and almost all that the practitioner need desire may be accomplished with its aid.

Microscopes are of two kinds, the simple and the compound.

The Simple Microscopes, or those in which the magnified image is at once conveyed to the eye, are of two sorts—namely, those held in the hand, such as the Coddington or the Stanhope lens, and those mounted on a stand; the latter have a stage for holding the object to be viewed, a mirror for reflecting the light through transparent objects, and a condenser for throwing light on such as are opaque. Either of the former glasses will be found useful pocket companions, and when mounted on a small stand, such as is used by watchmakers and engravers, may be employed for dissecting the coarser tissues. The best instrument for this purpose, however, is Collins's "Lawson" dissecting microscope.

At each School there is now a microscopic class, in which certain special instruments are used, and the student will probably seek the advice of his teacher as to the best course which he should adopt in order to secure a useful instrument at a reasonable price, whether it should be binocular or otherwise. The student should take care to get an instrument with the universal screw, so that the objectives of any maker can be used by him. A quarter inch is the glass with which the student should work, and he will be able to test his instrument by an examination of animal cells—ex., pus and blood—rather than ordinary test objects.

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[1] Μικρος, small, and σκοπεω, to view.

The Compound Microscope.—This instrument differs from a simple microscope, inasmuch as the image of an object formed by the object-glass is further magnified by one or more lenses forming an eye-piece; or, in other words, the rays of light from an object being brought into a new focus, there form an image, which image being treated as an original object by the eye-piece, is magnified in the same way as the simple microscope magnified the object itself. It would be out of place to enter into any detailed descriptions of various microscopes. We may refer the student for fuller information to Dr. Beale's volume on "How to Work with the Microscope."

The best microscopes at the present time are those made by Ross, Smith and Beck, and Powell and Lealand, at a cost, varying according to the number of object-glasses and apparatus, from twenty-five to fifty or sixty pounds. But as before observed, the student, if he wishes for advice, had best consult his teacher in histological science.

The necessary accessory instruments are but few in number, consisting of a lamp for artificial illumination (Dr. Lionel Beale prefers a small paraffin lamp with a round wick, about 1*s.* 6*d.* in price; the Bockett lamp made by Mr. Collins is also good and moderate in price); a diaphragm for cutting off the most oblique rays of light, and those reflected from the mirror which are not required for the illumination of the transparent object; a bull's-eye condenser, for concentrating the light on opaque ojects; a pair of forceps; glass slides, three inches by one in size; thin glass covers; a few watch-glasses, pipettes, Valentin's knife for making thin sections; needles for unravelling various tissues, Brunswick black, spirits and water, glycerine, chromic acid and water (1 part to 200), turpentine, Canada balsam, &c. Should expense be no object, an achromatic condenser will be found useful, for examining those delicate structures which require achromatic light; a polarizing apparatus, for viewing various crystals and other substances by polarized light; a camera lucida, for making drawings of the appearances observed; and a micrometer, for measuring the size of minute objects.

In the perusal of foreign works on histological science, the student will be often confused by the standards of measurement employed in various parts of the Continent differing from each other, and from that used in this country—commonly the inch. The following table, from Hannover's "Treatise on the Microscope," will show at a glance the value of the different measurements:

Millimetres.	Paris Lines.	Vienna Lines.	Rhenish Lines.	English Inch.
1	.443296	.455550	.458813	.0393708
2.255829	1	1.027643	1.035003	.0888138
2.195149	.973101	1	1.0071625	.0864248
2.179538	.966181	.992888	1	.0858101
25.39954	11.25952	11.57076	11.65364	1

The following table shows the equivalents of millimetres in English inches:

		English Inches.			English Inches.
1 millimetre	=	0.03937079	40 millimetres	=	1.5748
5 "	=	0.19685395	50 "	=	1.968
10 "	=	0.39370790	60 "	=	2.362
15 "	=	0.5905	80 "	=	3.149
20 "	=	0.7874	100 "	=	3.937
25 "	=	0.9842	150 "	=	5.906
30 "	=	1.1811	200 "	=	7.874

For the microscopical examination of the blood, sputa, vomited matters, urine, &c., see Chapter XIV.

SECTION II.

THE TEST-TRAY.

In the practice of medical chemistry, a small quantity of apparatus, of an inexpensive nature, is all that is necessary, which may be conveniently arranged in a common wooden tray about fourteen inches long, ten broad, and five deep; it should be covered in at the top by a piece of deal, in which holes must be cut to receive the test-tubes, spirit-lamp, and bottles containing the reagents.

The following articles are those which will be mostly required: A spirit-lamp; a cylindrical precipitating glass; a urinometer, for taking the specific gravity; blue litmus paper, for testing acidity; slightly reddened litmus and turmeric paper, for testing alkalinity, the former being the most delicate; watch-glasses and evaporating dishes; half a dozen test-tubes; a thermometer, with an exposed bulb; a small retort stand; a blow-pipe; platinum foil; a glass funnel and filtering-paper; glass rods; one or two pipette forceps for extracting hairs; glass brushes for applying acids may be conveniently kept; and bottles for the following reagents: nitric acid, sulphuric acid, acetic acid, hydrochloric acid, liquor potassæ, liquor ammoniæ, a saturated solution of nitrate of barytes, solution of nitrate of silver (one drachm of the crystallized nitrate to the ounce of distilled water), solution of oxalate of ammonia, iodine solution, alcohol, and rectified ether. Should the practitioner prefer a more portable case, he can purchase a case fitted up with every convenience at any of the instrument makers.

With these agents he will be enabled to make a clinical examination of the urine, blood, sputa, &c., as far as it is necessary to do so in the practice of medicine for the purposes of diagnosis. *For the mode of making a chemical analysis of the blood and secretions, see Chapter XIV.*

Details of Examination.—Objects may be viewed by transmitted light, and then must be sufficiently thin, or by reflected light when it is desired to examine the condition of their surface more particularly, and then opacity and thickness are of no consequence. For viewing with transmitted light, a thin section should be made, then placed in some medium of about the same density as that which surrounds the tissue to be examined. Dr. Beale suggests albumen and water. Highly refracting structures are seen to advantage by immersion in glycerine and water. To render transparent tissues opaque, alcohol and water may be used, as also chromic acid, and sometimes glycerine. The tissues may be also colored by a little Prussian blue, or a weak solution of carmine in ammonia. Tissues may be rendered transparent by weak glycerine and water, by the action of acetic acid, which dissolves earthy matter and clears up granular matter, as in the definition of the pus corpuscle, and by the operation upon them of alkalies. Ether dissolves fatty matter. Liquor potassæ is used to opaque albuminous substances, in strong solution to dissolve, and in weaker solution to render them transparent. Dr. Beale finds a mixture of water 1 oz., glycerine 1 oz., spirit 2 oz., acetic acid 2 drs., and hydrochloric acid ½ drm., of use in defining the structure of epithelial formations. Alcohol and soda, in the proportion of eight or ten drops of caustic soda to an ounce of alcohol, according to the same authority, is "especially adapted for investigations upon the character of calcareous matter deposited in tissues in various morbid processes." Canada balsam is a good medium for mounting; but all water must be driven away from the object to be mounted, first of all by soaking and resoaking in an alcoholic solution of acetic acid or soda, then placing in an ethereal solution of Canada balsam; the ether drives away the alcohol from the preparation, which can then be finally mounted.

How to Measure Microscopical Objects.—Several plans have been recommended for ascertaining the dimensions of microscopic objects; the following, provided a little care be taken at the commencement, is the readiest and most accurate.

Place the tube of the microscope in a horizontal position, and fix on the stage a stage micrometer marked in hundredths and thousandths of an inch, then with the inch objective bring these lines into focus. Now remove the cap of the eye-piece and replace it with a neutral tint glass reflector. The microscope should now be raised to such a position that the distance from the eye-piece to the stage shall be equal to the distance between the eye-piece and the table.

Next, on a piece of paper placed on the table under the neutral tint glass, mark off the lines that are seen by looking down through it in the ordinary way, and do this with both sets of lines. On the edge of a card repeat these dots by placing it against those on the paper. The whole process should be repeated with the quarter-inch objective.

In this way we have made a scale by which we can measure any object afterwards, provided that the same microscope eye-piece and objective be used. Thus, to measure an object we have only to sketch its outline with a neutral tint glass in the usual way and then measure off with the scale already prepared the number of thousandths or hundredths of an inch that it covers.

SECTION III.

THE SPIROMETER.

Under the designation of the pulmometer, the spirometer has been known for the last half century, but it was of no practical utility until the vital capacity of the lungs was ascertained by the laborious researches of Dr. Hutchinson.[1]

Hutchinson's Spirometer.—This instrument—somewhat resembling a small gasometer—consists of a cylindrical vessel of japanned zinc, about two feet and a half high and two feet in circumference, capable of holding many pints of water. Into it is inverted a cylinder or receiver—somewhat smaller—which is counterpoised by weights; in its cover is inserted a movable plug. Communicating with the smaller cylinder is a tube, having an elastic tube and mouth-piece attached. A graduated scale is fixed to one side of the instrument, extending some distance above the top of the large cylinder. On respiring through the mouth-piece, the air passes into the lesser cylinder, and causes it to rise by displacing the water; an indicator attached to it marks on the graduated scale the number of cubic inches of air expired. We are thus enabled readily to measure the volume of air expired from the lungs.

When the vital capacity is to be tested by this apparatus, the patient should loosen his vest, stand perfectly erect, take as deep an inspiration as possible, and then place the mouth-piece of the spirometer between his lips. The observer having opened the tap, the patient empties his lungs, making the deepest possible expiration, at the termination of which the operator turns off the tap, thus confining the air in the receiver. The receiver is then to be lightly depressed until the surfaces of the spirit in a bent tube on the outside of the instrument are on a level with each other, when the vital capacity may be read off from the scale. The practical use of the instrument is noticed in Chapter VII.

Coxeter's Portable Spirometer is of much more simple construction than the preceding, and is so compact that it can be easily carried in the pocket. It consists simply of two flexible, inelastic, air-tight bags, each of which is provided with a stopcock at its free end, the larger having a mouth-piece. One bag is much larger than the other, but the two communicate by means of a piece of tubing provided with a stopcock. The smaller bag is capable of containing exactly 50 cubic inches of air. In using this spirometer the two bags are compressed in the hands, and the air expressed from them, and they are kept empty by closing the stopcocks ; if we take a deep inspiration, apply the mouth-piece, open the stopcock and expire, the expired air will be forced into the large bag, where we retain it by closing the tap ; by opening the communication with the duodenal portion, and letting it fill with the expired air from the large bag, we obtain precisely fifty cubic inches ; then, by closing the communication, and opening the escape valve, we have the smaller bag again empty, and ready to measure another fifty cubic inches, or thirty, or forty, as the case may be ; and so we proceed until the whole volume of the expired air in the large bag has been ascertained.

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[1] See "Medico-Chirurgical Transactions," vol. xxix, p. 138

Dr. Pereira's Spirometer.—This instrument is much the same in principle as Dr. Hutchinson's. It consists of a large glass cylinder, suspended by means of a cord, in a reservoir of water, the cord passing over a pulley, and having a weight attached, so that by careful adjustment the cylinder may balance in any position. A pipe, forming the continuation of the tube through which the patient has to breathe, rises in the bell-glass above the level of the water ; and by forcing the air through this tube, the vessel will ascend, and indicate, by a graduated scale affixed, the quantity of air passed into it.

SECTION IV.

THE TAPE-MEASURE, STETHOMETER, PLEXIMETER, STETHOSCOPE, ETC.

The Common Tape-measure.—A common measure, thirty-six inches in length, fixed in a small German-silver box, and made to act by a spring, will be found useful in the diagnosis of diseases of the lungs. To ascertain the *circumference of the chest* we pass the tape around it, over the region of the nipples ; should the patient have his shirt and flannel jacket on, we must make an allowance of a quarter of an inch for each of these articles. To learn the *mobility of the chest*, we pass the measure as just directed, request the patient to fill his lungs as much as possible by taking a deep inspiration, and note the number of inches on the measure, this being of course the greatest circumference; we then, without moving the tape, make him expire to his utmost, and noting the number of inches we shall have the minimum circumference; the difference between the maximum and minimum will give us the mobility of the chest. In healthy persons, of ordinary weight and middle age, the average mobility is three inches, very rarely extending to four. To compare the two sides, a double tape, consisting of a piece of German-silver with a tape-measure starting at each side therefrom, may be used. The plate is placed over and held to the centre of the spine, and the two tapes are brought round, the one the left side the other the right side of the chest, and compared in front at the central point of the sternum. A little difference must be made for the somewhat larger size of the right side of the chest in health, a quarter to half an inch.

The Stethometer.—An instrument called a stethometer, for measuring the expansive movements of the thorax during inspiration, and for ascertaining the difference in the mobility of opposite sides of the chest, has been invented by Dr. Richard Quain. It is a small machine about the size of a watch, with a graduated dial, and an indicator; a silk cord passes out of the side of the case and is connected by an axle with the indicator, which is capable of moving round the dial plate. The cord being extended from one fixed point on the chest to another, the extent of the respiratory movement becomes manifested by the tension made on the cord being communicated to the indicator, which thus shows the degree of expansion during inspiration, and of contraction during expiration. It is obvious that not only will the mobility of the chest be thus shown, but comparisons can also be readily drawn of the action of different parts of the chest, giving this instrument, therefore, advantages over the common tape-measures.

Dr. Sibson's Chest-measurer.—This instrument—somewhat resembling Dr. Quain's—is useful for ascertaining the expansion of the chest, and for accurately measuring the movements of respiration to the hundredth part of an inch. In form it resembles a watch, with a small bar or rack protruding from its lower part. This rack, when raised by the moving walls of the chest, moves, by means of a pinion, the index on the dial; one entire revolution of the index showing one inch of motion in the chest, and each division indicating the hundredth of an inch.

Plessors, Pleximeters, &c.—In practising percussion, the fingers, as a general rule, are superior to any artificial instruments. Occasionally, however, a small hammer tipped with gutta percha, or a thimble headed with the same material, may be useful as a plessor (πλήσσω, I strike), and may enable us to produce a clearer stroke; these may be employed either for striking on the index or middle finger as a pleximeter (πλήσσω, and μέτρον, a measure), or the pleximeter may consist of a small thin disc of ivory—as used by M. Piorry, or of wood, or India-rubber, each being provided with lips which are used as handles. In some regions it is not always possible to percuss with the fingers with an equal degree of force on the two opposite sides, as in the axillæ. In such instances, Dr. Sibson's ingenious spring pleximeter may often be used with advantage, since by it successive strokes are produced exactly of equal force, which ought consequently to elicit, under similar circumstances, exactly the same sound. Another advantage possessed by this instrument is the ease and precision with which it can be applied over the clothes, in which respect it will be found useful in percussing children and females, as well as men during the cursory examination usually made at the life-assurance office.

The Stethoscope.—The stethoscope (στῆθος, the chest, and σκοπέω, to examine), is a cylinder of soft wood—generally cedar—from four to eight or nine inches in length, pierced through by a longitudinal canal about a quarter of an inch in diameter, and having one extremity large and flat as an ear-piece, while the other is much smaller and funnel-shaped for application to the thoracic walls. The object of such an instrument is to collect and convey to the ear of the observer, the vibrating impulse of the air, or of the solid walls of the thorax, occasioned by the perpetual movement within. Stethoscopes are made in endless variety, with and without solid stems.

General Observations.—From the numerous diseases which derange the acts of respiration, and from the great variety of disturbed chest movements, it is clear that we cannot form a diagnosis from the mere observation of the exaggeration, restraint, or arrest of any special movement. We are not therefore directed to any final diagnosis by the indications derived from the spirometer, the chest-measurer, the educated eyesight, or the touch; by these we are merely led to make correctly the first step; from them we only learn that there is derangement, and in some cases its seat. By the aid of percussion we advance still farther; while by the practice of auscultation—aided by a knowledge of all the symptoms—we are enabled, in the great majority of cases, to give an accurate opinion as to the situation and exact nature of the disease, whether it be fixed in some part of the organs of circulation or of the organs of respiration. Neither of the instruments described in the preceding paragraphs must be trusted to alone; neither the spirometer nor the stethoscope may be leant upon as a crutch, but merely employed as a staff to explore the way; auscultation and percussion are no substitutes for other methods of diagnosis, though they are most valuable auxiliaries.

The Dynamometer.—The dynamometer is an instrument, invented probably by Mr. Graham, but improved by M. Regnier, for measuring the comparative muscular strength of men and animals; and although not used perhaps in the practice of medicine, at least to any extent, still it deserves mention. It consists of an elliptical steel spring, of about twelve inches in circumference, connected with an index and needle, so that when by pressure the two sides are made to approach each other, the needle moves upon a portion of a circle furnished with a scale of kilogrammes, and one of myriagrammes. For example, to measure the strength of the hands, the two branches of the spring are firmly grasped, and brought as near together as the experimenter's strength will enable him to accomplish. The needle traversing the scale of kilogrrammes, indicates the strength of the hands. Some interesting results relating to the average strength of men at different ages, and of various weights and sizes, have been deduced by M. Quetelet, of Brussels, from numerous trials with this instrument. According to these experiments, a man twenty-five or thirty years of age is said to exert a force equal, on an average, to fifty kilogrammes, 100 pounds, but the amount must necessarily vary considerably.

Diaphæmetric Compass.—This instrument has been constructed and is used by Dr. John W. Ogle for the purposes of measuring and indicating the power possessed by the skin of "contactile discrimination," *i. e.*, the faculty of detecting the double impression made on the surface of the body when two points are made simultaneously to touch it within a given distance of each other.

The instrument is described and figured in Beale's "Archives of Medicine," 1859, No. 4, and consists of a pair of mathematical compasses with the usual joint, furnished with a circular dial-plate, whose circumference is divided into inches and tenths and twentieths of an inch, and provided with a central hand or indicator which may be turned in any direction so as to point to the various subdivisions. This dial is attached to the anterior surface of one of the legs of the compass; and the indicator on its surface is moved by means of a small-wheeled pinion behind the dial, of which the pivot is connected with it through the dial. Into this wheeled pinion behind the dial works a segment of a tooth-wheel, which is attached to the other leg of the compass in such a manner that when the legs are separated—that is when the compass is opened—the tooth-wheel working in the pinion moves the indicator on the face of the dial, and makes it point to the various subdivisions. Thus the exact distance at which the points of the compass are separated may be "read off" on the graduated face of the dial-plate.

When describing the instrument, Dr. Ogle, after reviewing our knowledge of the faculty of contactile discrimination and tactile sensibility generally, possessed in a healthy or physiological state by the skin, proceeds to notice pathological instances in which owing to affections of the nervous system, of cerebral or spinal origin, modifications exist in this capacity of appreciating double impressions made at one time on the skin. He refers to cases of disease in which the contactile discriminating power may be either increased or diminished, and in which variations therein may become practically useful in pointing out to a certain extent the degree in which the nervous system is affected, and also what advances may have been made towards a re-establishment of a healthy condition, a point of importance in relation to prognosis.

The Hypodermic Syringe.—This is an instrument used for the purpose of injecting into the subcutaneous cellular tissue various remedies which are there readily absorbed, and produce a rapid effect upon the system. The instrument consists of a small glass syringe, holding about half a drachm or so, and carefully graduated into drops; and of a long and fine tube (an inch or so long, armed with a point), which can be thrust into and through the skin, and which allows the fluid contained in the syringe to flow out through its point when the piston is worked. This is done generally by a screw action, each turn of the screw forcing out exactly one drop. In using the syringe a portion of skin may be pinched up, and the needle or tube forced obliquely through it into the cellular tissue, veins being carefully avoided.

We cannot refrain from giving here for the benefit of the student and practitioner a short account of the hypodermic method of treatment, as it is being largely used, and is not generally detailed in clinical works.

Subcutaneous injection, before its general principle of action was understood, was only used as a topical means of treating local neuralgic affections, or to produce *local* effects, as upon nævi, enlarged veins, aneurismal tumors, &c., by Dr. A. Wood, of Edinburgh, in 1844; and Rynd of Dublin seemed independently to have had the same idea of the local action of injected narcotics in cases of sciatica and of neuralgia. In 1858 the local theory of Dr. Wood was called in question by Mr. Charles Hunter, who carefully investigated the action of a variety of medicines hypodermically injected, upon patients in St. George's Hospital.

Mr. Hunter made a number of most careful experiments in neuralgic cases, and showed that distant injections were quite as efficacious as localized ones, provided the agents were placed in the cellular tissue beneath the skin, and *not* in the substance of the skin, as is the case in many of the instances of subcutaneous injection. He showed that the agent thus introduced acted, through the aid of absorption from the subcutaneous cellular tissue, rapidly and generally. Mr. Hunter showed that even if narcotics and sedatives were injected close to an affected nerve, the pulse was always influenced before the pain was relieved, and that therefore the agent went the round of the circulation before it did its expected good.

And thus the general principles of the method came to be established, and in 1859 Mr. Hunter laid down these dicta, which have been thoroughly corroborated by the Hypodermic Committee of the Royal Medico-Chirurgical Society appointed to investigate his assertions—namely, (1.) That equal effect upon an affected nerve follows the injection whether it is made close to or distant from the neuralgic nerve. (2.) That by varying the site of the injection the evils of repeated localization are avoided. (3.) That diseases which are neither localized nor neuralgic can be thus treated. (4.) That therefore other medicines besides anodynes can be thus administered with the advantages which are peculiar to this special mode of administration. (5.) These advantages are considerable in cases of *urgency*, in which the *immediate* and *direct* effects of the medicinal agents are required upon the system. Under such circumstances hypodermic injection of remedies far surpasses the administration of similar doses by the mouth or rectum. As regards the doses, they should always be less than ordinary stomachic doses, half or a third less for males, and one-fourth or less for females.

SECTION V.

THE LARYNGOSCOPE AND ITS USE.

For nearly a century methods have at various times been suggested for examining the lower part of the throat during life; with the unsuccessful, or only partially successful, attempts, it is sufficient to mention the names of Bozzini, Cagniard de Latour, Avery, Babington, and Garcia, who worked at the subject.

It was not, however, until 1858 that Professor Czermak, of Pesth, brought to perfection and practical application the laryngoscope of Garcia, which Türck, of Vienna, had unsuccessfully endeavored to employ a few months previously.

The laryngoscope is "an instrument for obtaining a view of the larynx during life; it consists of two parts: 1st, a small mirror fixed to a long slender shank, which is introduced to the back of the throat; 2d, an apparatus for throwing a strong light (solar or artificial) on to the small mirror. For thus projecting the luminous rays, a second (larger) mirror, which reflects the light from a lamp or the solar rays, may be employed; or artificial luminous rays may be concentrated by a lens directly on to the small mirror. When artificial light is employed, the illuminating mirror is slightly concave; when sunlight is used, its surface is plane."[1] In describing the various portions of the laryngoscope we shall for the sake of simplicity confine our attention principally to the instruments used by Dr. Morell Mackenzie, many of whose modifications are very ingenious, and to whose work we can conscientiously refer our readers for more detailed information.

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[1] "On the Use of the Laryngoscope." By Morell Mackenzie, M.D. Lond., &c. Second edition. Hardwicke. 1866.

The laryngeal mirror is of a circular shape, and made of glass, backed with amalgam, set in a German-silver frame, and attached to a shank of the same metal, at an angle of 120°; the shank is fitted into a slender wooden or ivory handle. The mirrors, which are of three sizes—No. 2 the most convenient—are about one-twentieth of an inch in thickness; the shank should be about four inches in length, and the handle about three inches in length. The *reflector* is a circular mirror about three inches and a half in diameter, with a small oval hole in its centre, and fixed to the head-piece by a ball and socket joint. The mirror is by some attached to an elastic band, which encircles the head of the operator, by others fixed to a horizontal arm, which is connected with the body of the lamp. Dr. Mackenzie's method of attaching it to a spectacle-frame, the upper orbital rings of which have been removed, and the whole covered with wash-leather, is not only the most comfortable, but the most convenient for adjustment and removal.

Light.—Sunlight being too inconstant ever to be universally used in this country, one is obliged to use artificial light for the purposes of laryngoscopic examinations. Any lamp that gives a bright steady light answers the purpose perfectly well. Many of the most valuable observations have been made with a common "moderator," and the reading-lamp, known as the "Queen's," is for country practitioners very convenient. Where gas is obtainable, a reading-lamp with an argand burner, which can be attached by a tube to any gaselier, answers every purpose; while for the physician in common practice with this instrument, the rack-movement laryngoscopic lamp, which readily admits of perpendicular and horizontal movement, will be found to greatly facilitate the management of the light. With all these lamps it is very desirable to have a concentrating lens. Many Continental physicians use direct in place of reflected light, and there is no doubt that for simple examination, or for demonstration to others, the direct light is very suitable. For the application of remedies, and for operations, however, reflected light is greatly to be preferred, on account of the ease with which by it the operator can follow the slight movements of his patient. For the purposes of demonstration the oxyhydrogen light is most convenient, but of course impracticable, on account of expense and constant trouble in preparing the hydrogen gas, for the private practitioner. Dr. Mackenzie uses this light in his hospital practice. The apparatus is so contrived that as many as six people, in addition to the demonstrator, can simultaneously witness the larynx of each patient examined.

Method of Examination.—The patient should sit upright, facing the observer, with his head inclined very slightly backwards. The observer's eyes should be about one foot distant from the patient's mouth, and the lamp should be so arranged that the flame is on a level with the patient's eyes. The observer should now put on the spectacle-frame with the reflector attached, and directing the patient to open his mouth widely, should endeavor to throw a disc of light on to the fauces, so that the centre of the disc corresponds with the base of the uvula. The reflector is worn by some over the forehead, but by far the most convenient method is to place it over the eye nearest the light,[1] with the long diameter of the hole in the reflector corresponding with the long diameter of the eye. When direct light is used, the patient has simply to sit opposite the lens of the lamp. The light being well directed, the patient should be instructed to put out his tongue, and the observer should hold the protruded organ gently, but firmly, between the finger and thumb of his left hand, the thumb being above and the finger below. To prevent the tongue slipping, the observer's hand should be previously enveloped in a small soft cloth or towel, and he should be careful to keep his finger rather above the level of the teeth in order to prevent the frænum being torn. (In applying remedies, the patient should be taught to hold out his tongue, in order that the operator may be able to introduce the mirror with his left hand, whilst with the right he applies the remedy to the affected part.) The observer should then take the small laryngeal mirror, and after warming its reflecting surface for a few seconds over the chimney of the lamp (to prevent the moisture of the expired air being condensed on it), should introduce it to the back of the throat. Before introducing the mirror, in order to prevent its being unpleasantly hot, the practitioner should test its temperature by placing it on the back of his hand. The mirror should be held like a pen, in the right hand, and quickly introduced to the back of the throat, its face being directed downwards and kept as far as possible from the tongue. The posterior surface of the mirror should rest on the uvula, which should be pushed gently rather upwards and backwards towards the posterior nares. When the mirror has been thus introduced without irritating the fauces, the observer should raise his hand slightly and direct it outwards towards the corner of the mouth. This rotatory movement alters the inclination of the mirror, turning its face more towards the perpendicular, and thus bringing the larynx into view, whilst at the same time it moves the hand from the line of vision. The exact angle which the mirror should bear to the laryngeal aperture must depend on the degree of flexion backwards of the patient's head, the particular angle which the plane of the laryngeal aperture bears to the horizon in the case undergoing inspection, and on the position of the observer. Undue faucial irritability may exist, and other causes uncontrollable by the observer; but in the majority of instances in which the practitioner is unable to make a satisfactory examination, the fault is with the observer, not with the patient. For the purpose of witnessing the action of the vocal cords, the patient should be directed to inspire deeply, or to produce some vocal sound: such as "ah," "eh," "oh," &c. The beginner must remember that in examining the larynx the objects are reversed in the mirror, *not as regards right and left*, but with reference to the antero-posterior direction, the part which in reality is nearest to the observer, the anterior commissure of the vocal cords, becomes furthest in the image, and the posterior or inter-arytænoid commissure, which in reality is farthest from the observer, becomes nearest in the image.

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[1] The reason of this arrangement is, that both eyes of the observer are screened from the glare of the lamp. This is not the case when the reflector is worn over the forehead.

Application of Laryngoscopy in Practice.—This invention is useful not only in diagnozing diseases, but is also a very valuable aid to treatment, by enabling the practioner to see that he touches only the point of disease when he makes an application, and to witness from day to day the improvement or progress in the disorder. The affections which can be examined and treated by this method are acute, subacute, and chronic laryngitis, tubercular, syphilitic, and malignant disease; paralysis of the muscles acting on the vocal cords, and laryngeal growths. For the first six it may be sufficient to use solutions, whilst for paralysis it may be necessary to apply electricity directly to the vocal cords. These can be done easily after a short course of special education. For the removal of laryngeal growths, complicated and very delicate operations with forceps, wire loops, &c., are required, and great caution is needed. In œdema of the larynx, scarification by the laryngeal lancet (an instrument in which the lance is concealed, and only released by a spring at the will of the operator) is often of great service, and is another operation of delicacy, though by no means so intricate as the last-mentioned.

For applying solutions to the larynx, squirrel's or camel's hair pencils, cut square at the end, and attached to a piece of aluminium wire bent at an angle varying from 90 to 120 degrees, will be found most suitable From the angle to the end of the brush, the instrument should measure from an inch and a half to two inches and a half, and from the angle to the handle from four to five inches. Great care should be taken before each application to see that the brush is securely riveted to the wire. The laryngeal brush is very superior to, and has quite superseded, the sponge; it is well adapted for applying caustic, astringent, alterative, or sedative solutions.

For ordinary congestions and inflammations, Dr. Mackenzie uses aqueous solutions either of chloride of zinc (fifteen to thirty grains of the salt to the ounce), or of perchloride of iron (one to two drachms to the ounce). These are also useful in the thickening and ulceration of phthisis. In syphilitic ulcerations a strong solution of nitrate of silver may be applied to the diseased spot, or, better still, the solid nitrate of silver fused on to a slender rod of aluminium, the ulcers having been previously cleansed with a dry laryngeal brush. For the same purpose a solution of sulphate of copper (fifteen to twenty grains to the ounce), is sometimes serviceable as a change from the caustic. Tincture of iodine, and of catechu, oil of turpentine or of the wood-pine, and carbolic acid (thirty grains to the ounce), are each occasionally useful. Solutions of nitrate of silver are not recommended for general application to the larynx, as they are in no way superior to zinc or iron, and have a much greater tendency to produce spasm and nausea. With reference to spasm it may also be mentioned that the brush should not be too full of the solution, and that it should be applied as quickly as possible.

Galvanism is applied by a simple contrivance of Dr. Mackenzie, which connects one pole of the battery with a necklet which surrounds the patient's neck, and is fastened opposite the thyroid cartilage, while the other is connected with a "laryngeal electrode," which can be introduced into the larynx, and by a convenient stop on its handle the operator can always control and arrest the current. This arrangement can be applied to any electro-magnetic or magneto-electric battery. Galvanism is useful in many forms of paralysis of the laryngeal muscles, but especially in that which is known under the name of hysterical or functional aphonia. In many of these cases, if properly applied, galvanism acts like a charm.

Rhinoscopy.—It only remains to say a few words on the kindred subject of rhinoscopy. In this the patient being directed to expire gently or to produce some nasal sound, a mirror smaller in size than that used for examination of the larynx, but of smaller construction, is introduced to the back of the throat (its upper border being a little below the uvula), so that the plane of the reflecting surface forms with the horizon an angle of 130 degrees. It is seldom that the whole of the posterior nares can be seen with the mirror, as the soft palate generally eclipses the lower third; and as the uvula also is often liable to obstruct vision, it is recommended that the observer should introduce the mirror between the anterior pillar and the uvula on one side first, and then withdraw it and introduce it again in the same manner on the opposite side. In this way he will be able to inspect the whole of the posterior nares, and by first slanting the mirror a little towards one side, and then towards the other, the orifices of the Eustachian tubes will become visible.

For more detailed information we must refer to the work of Dr. Morell Mackenzie, to which we are mainly indebted for the foregoing.

SECTION VI.

THE THERMOMETER.

Several forms of clinical thermometer have been made by the surgical instrument maker, but these need no description. The most handy are those recommended by Dr. Clifford Allbutt, of Leeds, or Dr. Hawksley, which will be referred to in the section on "Thermometry in Disease." Care should be taken to ascertain the reliability of any instrument that may be purchased: the easiest plan is to check it by comparison with another thermometer used under like conditions.

SECTION VII.

THE OPHTHALMOSCOPE.

The ophthalmoscope is an optical instrument by the aid of which it is possible to see the interior of the eye. It consists essentially of a mirror, either transparent or having a central perforation, so that light can be thrown into the eye of the patient, while the head of the observer, without being so situated as to intercept this light, is yet placed in the track of its return, and sees the object from which it comes. If the mirror be used alone, the observer actually sees the fundus of the eye examined ; and this is called the *direct* method of examination, or the examination of the virtual or of the erect image. The structures of the fundus are then seen in their natural position. If, on the other hand, a strong biconvex lens be interposed between the mirror and the eye of the patient, the observer sees an aerial inverted image of the fundus. This method is the more easy of the two, and is the more commonly employed in practice. It is called the *indirect* method, or examination of the inverted image. The student who desires to perfect himself in its employment should obtain the artificial eye designed by M. Perrin, and made by M. Nachet et fils, with which any amount of practice can be obtained.

How to Work with the Ophthalmoscope.—To completely explore the whole fundus of the eye and to ascertain the state of the lens and the vitreous, the pupil should be widely dilated with atropine ; but where the desired information can be obtained without such a thorough investigation, it will be unnecessary and undesirable to submit the patient to this annoyance. The examination must be conducted in a darkened room, and with a lamp provided with a bright steady flame. The most convenient light is a small gas lamp at the end of a movable arm, which can be turned in all directions and raised or lowered as may be required. The burner should be a porcelain argand, protected with a piece of wire gauze below to regulate the draught. The chimney should be a tube of plain white glass, of a uniform diameter throughout its length. When gas cannot be obtained, a moderator or a reading lamp without the shade will answer almost as well. With all ophthalmoscopes, except the binocular, it will be found most convenient to place the lamp on the left-hand side of the patient, and with the flame on a level with, and a little behind, the eyes to be examined.

To use a monocular hand ophthalmoscope—say Liebreich's—the observer sits or stands in front of the patient, so that his eyes are a little above the level of those under examination, and at about eighteen or twenty inches distance from them. He then with one hand holds the ophthalmoscopic mirror close to his own eye, and at such an angle that he catches upon its polished surface the rays of light from the lamp, and reflects them into the eye of the patient. Looking through the sight-hole of the mirror into the eye thus illumined, he proceeds to make either an *indirect* or a *direct* examination of its fundus.

For the *indirect method* he holds in his other hand, between his forefinger and thumb, an object-glass of two or two and a half inch focus in front of the patient's eye, and at from one and a half to two inches distance from it, steadying the lens by resting his fingers on the forehead. By moving his own head a little backwards or forwards, as may be required, he soon succeeds in bringing into view a clearly marked *inverted* aerial image of the fundus of the eye he is examining.

The size of the inverted image may be increased by placing an ocular convex lens of about ten-inch focus in the clip behind the sight-hole of the mirror, and using at the same time an object-glass of from three to four inch focus. With this combination it will be necessary to approach the head nearer to the patient's eye. In order to obtain a view of the various parts of the fundus in succession, it is requisite to direct the patient to turn his eye in different directions, and for this purpose it is convenient to have fixed objects to which to call his attention. To see the optic nerve, the patient should be told to look at the tip of the observer's ear most distant from him ; thus, if the right eye is under examination, he should look at the right ear of the surgeon. By this means the globe is slightly inverted, and the optic papilla is brought under observation.

To examine the yellow spot, the patient should be directed to look straight before him at the eye of the surgeon, or through the sight-hole of the mirror.

For the *direct* method, or the examination of the erect image, no object-glass will be required. The best ophthalmoscope for this purpose is Zehender's or Coccius's, either of which is to be preferred to Liebreich's. The surgeon will have to approximate the mirror to within one and a half or two inches of the eye under examination. If either the surgeon or patient is myopic, a concave ocular lens should be placed behind the sight-hole of the mirror. When it is desirable to fully explore the fundus, the pupils should be dilated with atropine.[1]

The morbid appearances to be recognized by the ophthalmoscope in the diagnosis of general diseases, will be mentioned in Chapter V, Section 1.

SECTION VIII.

CHLOROFORM.

It so frequently falls to the lot of the house-surgeons and house-physicians of our hospitals to give chloroform, that we must needs say a few words on the subject, and we are indebted to Mr. Clover for the following hints. On the general exhibition of this important agent it is obvious much of its efficacy depends. In midwifery cases, and when used as an antispasmodic, it may conveniently be administered on lint or sponge, placed in a tumbler. Ten to twenty drops may be added every two or three minutes, so as to keep the material moist, without saturating it. For surgical operations, a towel rolled into a hollow cone, so as to cover the mouth and nose, is a convenient mode. A teaspoonful of chloroform may be poured on the towel to begin with, and fifteen minims should be added every two or three minutes when it is desired to increase the effect produced. We propose to describe the most usual modes of administering it, to which we shall add some practical suggestions as to the treatment of patients. Several modes of inhaling have been in use. Skinner's inhaler consists of a wire framework with a woollen cloth stretched across it, so as to cover the face. The chloroform is applied from a bottle arranged to drop only two or three drops at a time.

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[1] "Diseases and Injuries of the Eye." By George Lawson, F.R.C.S., &c.

Sir J. Y. Simpson has lately practised the following plan. He begins by oiling the nose and lips to prevent excoriation from the chloroform touching them. He covers these organs with a single thickness of towel, and upon that part which is opposite the patient's upper lip he drops the chloroform, so as to keep a space the size of half a crown saturated with it.

Dr. Snow's apparatus consists of a metallic vessel, holding the chloroform, and a face-piece with valves to prevent the air being breathed a second time. The vessel is surrounded with a water-jacket, so as to prevent the chloroform getting too cold to afford the requisite amount of vapor to the air passing over it. The expiratory valve is movable at will, so as to admit air into the face-piece during inspiration, and thus to dilute the dose.

Dr. Sansom has modified this apparatus by placing a thick coating of gutta percha over the chloroform vessel, and has replaced the somewhat heavy spiral tube by a double-jointed metallic tube. None of the foregoing methods, however, afford the means of measuring the percentage of chloroform accurately. The mode Mr. Clover adopts is to administer the chloroform mixed in a specific proportion with air, by means of a bag filled with a bellows, and holding 1000 inches. To this he supplies 32 minims of chloroform, which fall upon blotting-paper kept warm by a vessel of hot water. The mixture contained in the bag consists of about 96 parts of air and 4 of chloroform vapor, which assures a mixture neither too pungent to excite coughing, which may produce a sudden stoppage of the heart's action, or so feeble as to keep the patient long in the delirious stage. The chloroform can be further diluted by opening a side valve which is provided in the face-piece, and so admits fresh air. Whatever be the kind of apparatus used, it must be remembered that there are two special dangers to be guarded against—1st, syncope; 2d, apnœa. The inhalation of more than five per cent. of chloroform is likely to produce the first, and hence the bad results which have followed the pouring hastily on the towel a large quantity of chloroform to control the struggling of the patient during an operation. From apnœa death is less likely to happen, because if artificial respiration is effected whilst the heart is strong enough to carry on the circulation of the blood through the lungs, the patient recovers.

Before taking chloroform the patient should fast three or four hours, and no accumulation be suffered in the bowels; more especially in the case of obesity. He should be placed in an easy position on a couch, the dress should not be tight, so as to embarrass the free movements of the chest. The room should be kept quiet, and the patient forewarned that a sense of pulsation will be felt in the chest, and noises be heard like that in passing through a railway tunnel.

The cloth or sponge should never be allowed to touch the patient's lips, especially when fresh chloroform has been supplied. The attention of the adminstrator should never be diverted from watching the pulse and the respiration. When either is observed to indicate a loss of power, and whenever respiration has ceased for ten seconds, the chloroform should be removed for at least part of the next inspiration; but when in the early stages of chloroform narcosis the patient becomes hysterical, the breath may be held for thirty or forty seconds. This need cause no uneasiness if the pulse is beating well. If chloroform is given too strong, spasm of the glottis may occur, or the tongue may fall back so as to obstruct the entrance of air. In this case the chloroform should be removed and the chin drawn up as far as possible from the sternum, which will prevent the necessity for wounding the tongue by catching it with artery forceps. Sickness rarely happens unless the stomach contains food. When it does occur the administration of chloroform need not be suspended on its account, but the color of the lips should be carefully watched, lest they become livid, in which case the chloroform should be removed. A large piece of undigested meat might get into the glottis or pharynx, and require removal. General muscular rigidity often occurs, and when involuntary it is a sign that the patient has had sufficient chloroform for most operations. This depends, however, very much on the proportion of chloroform in the chest. If the last dose was a full one the effect is increased, and when the spasm goes off, the patient snores profoundly; but if it was a weak one, the patient becomes more sensible than before rigidity commenced. The proper antidote is pure air. Artificial respiration by Sylvester's method should be resorted to, if the breathing is stopped. In cases where the breathing is merely shallow and threatening to cease, it may be made more effective by pressing the abdomen and chest during expiration. After an operation the patient should be allowed to sleep, and nothing to eat or drink should be offered to him for an hour, and then tea or coffee is usually the best thing to begin with. He should be kept warm if necessary.

SECTION IX.

ELECTRICITY.

Electrical Apparatus.—The student and practitioner will often be called upon to employ electricity in the treatment of disease. It is impossible here of course to enter upon the subject of electro-therapeutics. All that is admissible is an outline of the kinds of electricity of service, the apparatus used in the application of electricity, and the general nature of the cases in which it is available. There are three forms of electricity employed; the first is named generally *frictional* or *static*, and, as its name implies, it is produced by friction; the second is *galvanism;* the third *faradisation* (induced electricity). The latter kind of electricity is that mostly used in therapeutics. The instrument by which it can be applied should possess "a sufficient range of power, so as to bring at once, and when properly applied, the largest muscles into full and energetic contraction; easiness and a certain niceness of gradation, and immediate readiness for action, and capability of being placed out of action without involving trouble or loss of time;" and the form of apparatus (Volta-Faradaic) made by Stöhrer, of Dresden, and sold by Pratt, of 420 Oxford Street, is the best yet made for the practitioner. An excellent paper (from whence the quotation above is taken), On the Use of Faradisation, by Mr. J. N. Radcliffe, is to be found in the first number of the "Practitioner." The author has enjoyed unique opportunities of studying electro-therapeutics, and has summed up the most important practical points involved in a very clear and comprehensive manner.

Practical Application.—"When metallic conductors are used, according as they are (applied to the surface of the body) uncovered or dry, or tipped with layers of moistened leather or sponge, the electrical current may be limited to the skin and tissues immediately beneath, or made to pass to deeper-seated structures and localized in definite muscles or groups of muscles." This constitutes what Duchenne has termed "*localized electrization.*"

The state of the muscles, viz., their power of contracting under the influence of electricity, can be readily determined, and guides therefrom obtained as regards treatment. Various kinds of directors are used: wire-brushes for localizing the current to the skin, large sponge-holders for affecting the larger muscles, and various button-shaped directors, more or less sheathed by layers of leather, for limiting the current to the more superficial parts. It is necessary to moisten the sponges or the leather on the directors before using them.

For therapeutical purposes, each muscle or group of muscles, should be acted upon for about thirty seconds at a time, with intervals of a few seconds, and the whole period of application should extend from ten to twenty minutes as a rule.

The *therapeutical uses* of faradisation arise directly out of the physiological properties of faradaic currents. In respect of the muscular system, they rest entirely upon the power possessed by these currents of exciting muscular contraction, and the physiological consequences of such contraction—namely, increased growth and aptitude to action of the muscular tissue. The reaction of muscles against a faradaic current—*electro-motility*, so called—is unaffected, or it is variously modified in certain paralytic affections. When the electro-motility is normal, as in paralysis of cerebral origin, faradisation cannot make the contractility of the muscles more normal; and, as a rule, it is useless. When the electro-motility is diminished or exhausted, as in certain forms of spinal and local paralysis, faradisation may reinvigorate or recall the defective or lost motility. The broad rule for the application of faradisation in the treatment of paralyzed muscles is, indeed, this: *when the electro-motility is diminished or exhausted, then faradisation will be of service; when the electro-motility is unaffected it will not prove of any use.* The question, then, of the use or not of faradisation in a given case of paralysis, involves a primary question of diagnosis; and this diagnosis is altogether special, and can be determined only by the systematic examination of the affected muscles. Such an examination, excepting only in the ordinary forms of paralysis of cerebral origin, should be made in every case. The examination, however, it is to be repeated, must be of individual muscles, for, in the forms of paralysis in which faradisation proves most beneficial, not all the muscles of an affected limb may be equally paralyzed, and some may be unaffected while the motility of others is seriously damaged. To faradise equally the affected and the unaffected muscles—those muscles which are slightly and those which are most injured—would be to do harm rather than good, and at the best would be a haphazard practice. The condition of muscle in which faradisation is found chiefly beneficial most commonly exists in paralysis following certain lesions of the substance of the spinal cord, the paralysis of infancy, and local palsies arising from injury of a nerve, or which are classed as rheumatic palsies. If, however, the practitioner follows the rule of guidance given above, he will have no difficulty in any given case of determining whether faradisation is needed or not in its treatment. The chief caution to be borne in mind is, that in cases of centric origin *faradisation should not be had recourse to—or, indeed, any method of electrization—so long as actual mischief exists.*

There are certain forms of *quasi*-paralysis in which the electro-motility is intact, in which faradisation is of much benefit, although not so certainly or so surely as in cases of paralysis in which the electro-motility is impaired. The *quasi*-paralytic affections referred to are the so-called *wasting* palsy (progressive muscular atrophy), and local atrophy of muscles. In these cases, the paralysis of movement depends upon the loss of muscular tissue, that which remains acting normally under the faradaic contact, and as a rule responding to the volition. In some of these cases faradisation is an invaluable remedy, staying the onward progress of the wasting, and promoting the growth of the affected muscles.

As regards the *nervous system*, the most marked use of faradisation is in cases of local anæsthesia, particularly the local anæsthesia apt to occur in hysteria. In such cases the application of the electrical brush, or "whip," as some writers term it, is of great value.[1]

Machine for taking the Weight and Height of Persons.—A very good apparatus is made by Young and Son, Cranbourne Street, Leicester Square. The machine occupies less room than a common chair, and is sufficiently delicate to weigh any person to within an ounce.

The **Sphygmograph** will be noticed in Chap. V, Sect. 4.

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[1] Radcliffe, *loc. cit.* The reader should also consult the work of Duchenne on "Localized Electrization, and its application to Pathology and Therapeutics." Published by Hardwicke.

CHAPTER III.

ON DISEASE.

SECTION I.

THE NATURE OF DISEASE.

DISEASE is known only by comparing it with the standard of health, from which it is a departure. The line, however, which separates disease and health does not exist—there is a point at which we cannot say there is either health or disease. The standard of health varies in different individuals, but, speaking generally, it may be said that health consists in a natural and proper condition and proportion in the functions and structures of the several parts of which the body is composed. Physiology teaches us that these functions and structures have to each other, as well as to external agents, certain relations, which—being most conducive to their well-being and permanency—constitute the condition of health. But from the same science we also learn indirectly, that function and structure may be in states not conducive to their permanency and well-being—states which disturb the due balance between the several properties or parts of the animal frame; and these states are those of *disease*. Thus we learn from daily experience that in health the digestion of food is easy and comfortable. But when uneasiness, pain, flatulence, eructation, sickness, and the like, follow the taking of food, we know that the *function* of digestion is changed from the healthy standard—that it is *diseased;* and if this diseased function continue long, in spite of remedies which usually correct it, and if on examining the abdomen we find at or near the epigastrium a hard tumor, which anatomy teaches us is not there in health, we know that there is also *diseased structure*. We find then that there is *disease of function*, known by its deviation from a physiological standard; and a *disease of structure*, which we recognize by an anatomical standard. These varieties of disease are commonly combined, structural disease without disordered function being rare; while functional disease is often accompanied—or at all events followed—by change of structure.[1]

Functional Diseases.—The leading features of this class of diseases may be briefly spoken of in connection with the two most important systems of the body—the vascular and the nervous.

In the vascular system there may be an *excess* of blood, either generally or locally. Excess of blood generally causes plethora, with often increased natural secretions, increased functional vigor, irregular actions, excessive—and perhaps morbid—growths. Locally increased supply of blood merely gives rise to excitement, or to congestion, with oppression of the congested organ. A *defective* supply of blood may also be general or local; when general, producing anæmia; when local, causing defective secretions, loss of energy, and a tendency to disordered actions. The supply of blood may likewise be *perverted*, and thus produce disordered function.

In the nervous system we equally notice excessive, deficient, or irregular distribution of nervous force, giving rise to temporary loss of health. Nervous disturbance may exist alone, or may be combined with vascular irregularity, producing various affections of nutrition, secretion, absorption, evacuation, muscular motion, or of the sensorial offices, or of the intelligence and will. But, as before observed, functional derangement seldom continues long without producing—

Structural Diseases, which may be comprehended under the three heads of increased, diminished, and perverted nutrition. Dr. Williams (op. cit., p. 345) has arranged the elements of lesions of structure in a table, essentially similar to the one we are about to give. We have thought it best in the present shifting state of pathology to reproduce the table, as it conveys a very fair impression of the kind and variety of changes which go on in the body under the influence of disease. The student need not attach much importance to the table beyond its *general* usefulness.

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[1] Dr. C. J. B. Williams's "Principles of Medicine." Second edition, p. 2.

- Diseased Nutrition . .
  - Increased—Hypertrophy.
  - Diminished—Atrophy.
  - Perverted . . .
    - Inflammation.
    - Induration.
    - Softening.
    - Transformation and Degeneration.
    - Deposits . . .
      - Euplastic . . .
        - Cicatrices.
        - False membranes.
      - Cacoplastic . .
        - Cirrhosis.
        - Fibro-cartilage.
        - Gray tubercle.
        - Atheroma, &c.
      - Aplastic . . . .
        - Yellow tubercle.
        - Calcareous matter, &c.
    - Growths . . .
      - Non-malignant
        - Cysts.
        - Tumors.
        - Hydatids, &c.
      - Malignant . .
        - Carcinoma.
        - Encephaloma.
        - Melanosis, &c.
- Disorders of Mechanism .
  - Contraction.
  - Dilatation.
  - Obstruction.
  - Compression.
  - Displacement.
  - Rupture.

But diseases, besides being functional and structural, vary as to their character, progress, duration, and termination, and we have varieties according to difference in these several particulars. Certain stages of disease are generally made into those of *invasion*, *development*, *decline*, and *convalescence*.

Primary and Secondary Diseases.—By the former term the original disease, or the first of a series of changes is signified. Secondary disease means an affection consequent upon some other morbid condition or conditions, as the eruption of syphilis which follows a chancre.

Acute and Chronic Diseases.—The terms acute and chronic have been arbitrarily employed to indicate the extreme states, in respect to nature and duration, of certain diseases. It must be remembered, however, that acute diseases often become chronic, and *vice versâ*; that a disorder may be acute in its nature and chronic in its duration; and that there may be disturbed action in every intermediate degree between these two extremes.

Zymotic Diseases.—Zymotic (from ζυμόω, to ferment), is an epithet proposed to characterize the entire class of epidemic, endemic, infectious, and contagious diseases.

Epidemics (ἐπὶ, upon, and δῆμος, the people) are such diseases as occasionally infest a community, more or less generally, at the same time, and which are apt to recur at uncertain intervals, or which appear successively or simultaneously in various regions. They may be not inaptly compared to the blights or tribes of animalcules which appear and disappear without any evident cause, and which at certain seasons produce such havoc in the vegetable kingdom. Cholera, influenza, and fever are the epidemics from which we suffer the most severely. It is a disputed point how far some of them are spread by human intercourse, or by a general influence travelling over large areas of the world, as in cholera.

A disease is said to be *endemic* (ἐν, in or among, and δῆμος) when it is peculiar to, or especially prevalent in, any particular locality. Thus ague is endemic in low marshy districts, goitre in certain parts of Derbyshire, Switzerland, &c. But a disease may also be epidemic and endemic, as is the case with cholera, which appears to be endemic in India, and epidemic only in Europe.

Contagious diseases are those which are communicable from one person to another. The terms contagion and infection are generally employed synonymously, though some have applied the word infection to the communication of disease from the sick to the healthy by a morbid miasm or exhalation diffused in the air, reserving contagion to express the transmission by immediate or mediate contact. Since, however, it is obvious that these are merely modes of the same agency in the great majority of cases, it seems better to view contagion as merely one mode of infection. There are three modes in which infection may be produced: 1, through wounds or an abraded surface, as in hydrophobia, vaccination, &c.; 2, through contact, as we see in gonorrhœa, syphilis, and certain cutaneous affections depending upon the existence of parasitic plants or animals; and, 3, through exhalations from the skin, breath, perspiration, or other secretions, which becoming diffused through the air to a certain extent, infect those who come within reach of the poison, as is seen in measles, small-pox, pertussis, fevers, and similar infectious disorders.

Sporadic Diseases.—Diseases which attack only one or two persons at a time, and which supervene indifferently in every season or locality, from accidental circumstances, and independently of epidemic or contagious influences, are termed sporadic. Thus dropsy, cancer, gout, diseases of the heart, and the great majority of the affections to which flesh is heir, are sporadic. Occasionally, when an epidemic proceeds slowly from one person to another, the attacks are said to occur sporadically.

Continued, Remittent, Intermittent, and Relapsing Diseases.—Fevers are called *continued* when they pursue their course without any well-marked remissions. In *remittent* fevers certain intervals occur daily in the course of the disease, in which intervals there is no cessation of the fever, but simply an abatement or diminution. The remissions usually occur towards the morning, and continue for six, ten, twelve, or fourteen hours: they are followed generally by increased feverish excitement or exacerbation towards night, continuing for some hours. In *intermittent* fevers there is an interval of almost perfect health. The three common species of intermittent fevers or ague, are the quotidian, tertian, and quartan. When the paroxysm occurs at the same hour every day, it is called quotidian ague; when every other day, tertian, though secundan would be more appropriate; and when it is absent for two whole days and then recurs, quartan. In the first species the interval is twenty-four hours, in the second forty-eight, in the third seventy-two. The time between the commencement of one paroxysm and the beginning of the next is termed the interval; that between the termination of one paroxysm and the commencement of the next, the intermission. In *relapsing* fevers, during convalescence, the disease, which appears to have gone, returns.

Hereditary, Congenital, Acquired, Specific, and Malignant Diseases.—*Hereditary* diseases are such as are transmitted from an ancestor or parent to a descendant or offspring; they may exist at birth, or may become developed at any subsequent period of life: gout, cancer, asthma, epilepsy, stone, and scrofula, furnish examples. *Congenital* affections are those born with the individual, as congenital cataract, hernia, &c. Hereditary and congenital affections differ from those which are *acquired*, that is to say, derived from causes operating after birth. The term *specific* is sometimes applied to diseases which are marked by some disordered vital action not belonging to disease in general, but peculiar to the individual case; thus syphilis and hydrophobia are specific diseases. *Malignant* diseases are those which are of a highly dangerous and intractable character, and the symptoms of which are generally very formidable from the commencement. Certain forms of typhus and typhoid fever, which rapidly depress the vital energies, are said to assume a malignant type; so again, cholera is often called malignant. By some this term is used to denote cancerous affections.

Asthenic, Idiopathic, Symptomatic, and Intercurrent Diseases.—Most of these terms explain themselves, but it may be as well to mention that diseases attended by manifest depression of the vital powers are said to be *asthenic*, in contradistinction to those marked by activity of the vital forces—*sthenic* disorders. Diseases, also, which are not dependent upon or symptomatic of others, are called *idiopathic* or *primary;* while *intercurrent* disorders are those which arise in individuals from incidental causes during the prevalence of other diseases.

Diathetic Diseases.—The term diathesis is applied to certain specific constitutional tendencies, and these are—the consumptive, the scrofulous, the cancerous, the hemorrhagic, the calculous, the gouty, and rheumatic diatheses.

SECTION II.

THE CAUSES OF DISEASE: ETIOLOGY.

Whatever is capable of deranging either the functions or any part of the structure of the human body, must be ranked amongst the causes of disease. It is not surprising therefore, considering the numberless variety of circumstances to which man is exposed, that these causes are very numerous, that in any particular case they often elude our observation, and that many attempts have been made to classify them without any marked success. Thus they have been divided into (1) external or extrinsic, and internal or intrinsic, according as they operate on the body from without or from within—such as the action of morbid poisons, venoms, miasmata or injuries on the one hand, and the retention of excreta giving rise to gout or overtaxing of the mind, &c., inducing brain mischief on the other ; (2) predisposing and exciting ; (3) general and local ; (4) proximate and remote ; (5) *causæ abditæ* and *causæ evidentes;* (6) mechanical, or (7) chemical, and physiological ; and so on. The true, simple view of all causes is, that they are circumstances of the most variable nature inducing disease ; and the most simple division of them probably is into predisposing and exciting. They may be arranged in two groups, partly according to the plan adopted by Dr. C. J. B. Williams, in his excellent work on the "Principles of Medicine," from which we have already quoted.

1. Predisposing Causes of Disease.
   - Debilitating influences.
   - Excitement.
   - Previous disease.
   - Present disease.
   - Hereditary constitution.
   - Temperament.
   - Age.
   - Sex.
   - Occupation.
   - Climate.
2. Exciting Causes of Disease.
   - A. Cognizable Agents . . .
     1. Mechanical.
     2. Chemical.
     3. Ingesta.
     4. Bodily exertion.
     5. Mental emotion.
     6. Excessive evacuation.
     7. Suppressed or defective evacuation.
     8. Defective cleanliness, ventilation, and drainage.
     9. Temperature and changes.
     10. Parasitic plants and animals.
   - B. Non-cognizable Agents . . .
     1. Endemic
     2. Epidemic
     3. Contagious

     } Poisons.

Causes are also sometimes said to be *primary* and *secondary:* these terms need no explanation. Secondary causes are those which, inducing mischief in the system, are themselves called into existence as the result of exciting disease.

The scope of the present Manual will not permit of our treating of each of these causes *in extenso*, neither is it necessary to do so. We must, however, say a few words on the non-cognizable causes or those due to miasmata secreted by the human body, or generated largely from unknown sources, which especially deserve the attention of the medical philosopher, since they are most appalling in their effects, and but very little is known of their nature. These morbid poisons are all subjected to certain general laws, the most important of which are—

1. That they all run a definite course, and have, not capricious, but certain definite and specific actions, and that they each affect especially certain organs, as in scarlatina—where the eruption differs from all other eruptions, runs a course peculiar to itself, and where the force of the poison is expended on the skin and mucous membranes; in hooping-cough—where the virus affects the organs supplied by the eighth pair of nerves or the pneumogastrics.

2. That, after mingling with the blood, they continue in latent combination with this fluid for a certain period of time—the period of *incubation* as it is called—before their specific actions are set up. Thus, in small-pox there is a latent period—between infection and the appearance of the phenomena of the disease—of from twelve to fifteen days; in measles from twelve to fifteen days; in scarlatina from four to six; and in ague an unknown period, twelve months even having elapsed between the time of exposure to the malaria and the appearance of the fever.

3. That the phenomena resulting from the poison, when roused into action, vary to a certain extent, according to the strength of the poison, and the predisposition, temperament, and constitution of the patient.

4. That they possess the power of generating to an immense extent a poison of the same nature as that by which the disease was first produced. Thus a quantity of small-pox virus almost inappreciable in size may produce thousands of pustules, each containing fifty times as much pestilent matter as that originally introduced.

And 5. That many of these poisons possess the extraordinary power of exhausting all future susceptibility in the constitution of the affected party to any similar action of the same agent, as is well known to be the case in scarlatina, small-pox, hooping-cough, &c.

In considering the importance of the various causes of disease individually, the student must bear in mind that disease may be induced by one only, or by several acting together or in succession; and that they are modified by several circumstances, but especially by the *vis medicatrix naturæ*, which, in healthy persons, is sufficient to resist the force of many circumstances that would otherwise give rise to disordered action.

SECTION III.

THE CLASSIFICATION OF DISEASE: NOSOLOGY.

In order to simplify the study of morbid processes, it has been found necessary to briefly designate the important peculiarities, phenomena, and situations of diseases, and to classify them according to some definite plan, dividing and subdividing them into classes, orders, genera, and species. The word Nosology is used to express this classification. Several nosological systems have been proposed.

The great error in the classifications which have hitherto been attempted is, that symptoms are regarded as the essential parts of disease, whereas they are merely indications, are very variable, and by no means uniformly correspond with the amount of disordered function or diseased structure present. There are many difficulties in the way of making a perfect classification, but something has recently been done toward a more general agreement as to the best tentative mode to be adopted. The College of Physicians have prepared a system of classification, with the aid of the various officials and heads of departments whose business it is to preside over the registration of disease; and it is supposed that every practitioner will possess himself of a copy of the new Report. In the preface, written by Sir T. Watson, to the work, we are told that—

A good classification aids and simplifies the registration of diseases; helps towards a more easy comparison and knowledge of them, and towards the storing of experience respecting them; and facilitates the discovery of general principles from the collected, grouped, and compared phenomena.

Diseases might be classified according to their symptoms; to their causes; to their intimate nature; to the tissues, or to the systems, of the body that are affected; or to the parts of the body as they lie anatomically.

After much consideration, the joint Committee of the College of Physicians and representatives of public bodies resolved "that the proposed classification of diseases should be based upon anatomical considerations."

In subservience to this anatomical distribution, diseases are to be grouped as being general or local.

General diseases are such as affect the whole frame rather than any special part of it. Local diseases are such as occupy special parts of the body.

General diseases are directed to be subdivided into two sections, A and B.

Section A comprehends those disorders which appear to involve a morbid condition of the blood, and which present for the most part, but not all of them, the following characters. They run a definite course, are attended with fever, and frequently with eruptions on the skin, are more or less readily communicable from person to person, and possess the singular and important property of generally protecting those who suffer them from a second attack. They are apt to occur epidemically. Of these epidemic visitations Dr. Farr observes, that they distinguish one country from another, one year from another, have formed epochs in chronology, have decimated armies, and disabled fleets, have influenced the fate of cities, nay, of empires.

Section B comprises, for the most part, disorders which are apt to invade different parts of the same body simultaneously or in succession. These are sometimes spoken of as constitutional diseases, and they often manifest a tendency to transmission by inheritance.

The details of these two groups may be thus expressed:—

1. General Diseases.

Section A includes small-pox, cow-pox, chicken-pox, measles, scarlet fever, dengue, typhus, cerebro-spinal, enteric, relapsing, and simple fevers, febricula, yellow fever, plague, ague, remittent fever, cholera, diphtheria, hooping-cough, mumps, influenza, glanders, farcy, equinia malignant pustule, phagedæna, hospital gangrene, erysipelas, pyæmia, puerperal fever.

SECTION B. Acute rheumatism, gonorrhœal and other forms of rheumatism, gout in its various forms, syphilis, cancer, non-malignant tumors of all kinds, lupus, rodent ulcer, true leprosy, scrofula, rickets, cretinism, diabetes, scurvy, anæmia, chlorosis, general dropsy, beriberi.

2. Local Diseases.

These are arranged under several heads according to the part attacked—ex., diseases of the nervous system, eye, ear, nose, circulatory system, absorbent system, respiratory system, digestive system, urinary system, generative system, female breast, and in addition, organs of locomotion, cellular tissue, and cutaneous system. The arrangement of the details under each of these heads is directed to be given in accordance with a definite scheme which we cannot notice here.

In addition to general and local diseases, the College of Physicians' scheme includes

3. Conditions not necessarily Associated with General or Local Diseases.

Under which heading are included still-born cases, premature births, old age, debility.

4. Poisons.

5. Injuries.

a. General, such as burns, scalds, lightning stroke, multiple injury, asphyxia, privation, exposure to cold, infant exposure, neglect.

b. Local, specified according to the part injured.

The Appendix to the Report on the Classification of Disease contains the headings of—

Surgical Operations, Human Parasites, and Congenital Malformations.

SECTION IV.

THE DIAGNOSIS OF DISEASE.

The correct diagnosis of disease—the distinction of diseases from one another—is the most important part of the physician's duty. To discriminate well the malady, and to discern its effects upon the patient, requires the highest skill—a skill which can only be obtained by observation and practice.

The valuable instrumental aids to diagnosis so much multiplied of late years have already been described, but these come into employment when the observer has defined the seat at which he will probably find disease.

In attempting to make out the general nature of a disease every branch of medical knowledge must be brought to bear upon the injury, information must be sought from every source likely to afford aid. Having carefully learnt the general history of the patient, we must examine all the symptoms, investigate the condition of suspected tissues or organs, inquire into the assigned cause, and take into consideration all controlling influences, such as age, sex, temperament, habits, modes of living, constitutional peculiarities, &c. Accidental circumstances often aid us considerably, especially when the patient is unwilling to impart all the information he is capable of giving. At the same time the feelings, prejudices, and mental peculiarities of the sufferer must be consulted, and the practitioner should endeavor to come to a correct conclusion with as little that is disagreeable to him as possible.

A reference to the section on classification will best aid in giving a general idea of the main peculiarities of the several groups and classes of disease.

Bishop Butler has well said that "probability is the guide of life," since man may have sufficient evidence in a thousand cases to warrant his actions, though that evidence is very far removed from certitude. This is especially the case in the diagnosis of disease, numerous maladies being discriminated, treated, and cured as often under the guidance of sober conjecture as of undisputed certainty. Such conjecture, however, is very different from arrogant guesswork, which fails more frequently than it succeeds, and knows not why it succeeds or fails. "The conjecture which should guide the physician is rigorous, and calculating, and honest. It acts strictly by rule, and leaves nothing to chance. It does not absolutely see the thing it is in quest of, for then it would no longer be conjecture. But, because it does not see it, it ponders all its accidents and appurtenances, and noting well whither they point, it takes aim in the same direction, and so oftener hits the mark than misses it. And succeeding thus, it knows why it succeeds, and it can succeed again and again upon the same terms. Next to knowing the truth itself, is to know the direction in which it lies. And this is the peculiar praise of a sound conjecture."[1]

The mode of diagnosing particular diseases will be treated of in a subsequent part of this work, and it is therefore needless to enter into any lengthy *general* statement.

SECTION V.

THE PROGNOSIS OF DISEASE.

In forming an opinion as to the future course, changes, and termination of any disease, we must be chiefly guided by our knowledge of the general progress of the class of disorders to which it belongs, by the effect which the disease has had upon the patient, by the degree to which it has hitherto been controlled by remedies, and by the extent to which they are likely to be further beneficial. It is usually of the greatest consequence that the character of a disease should be plainly perceived. In cases where there is a reasonable chance of recovery the stimulus of hope is of great service, and in itself favors the return to health. On the other hand, where a fatal termination is clearly indicated, a sick man, made aware of his danger, is enabled to arrange his worldly affairs, to make his will, and to prepare for the awful change that awaits him. Foreseeing the event of a disease, it becomes a question whether the practitioner should divulge his opinion. There is always some risk of losing instead of gaining credit, by strong statements, and confident predictions of the death or recovery of a patient.[2] It often happens that a person is dangerously ill of a disease from which, however, recovery is by no means impossible. To take away hope in such an instance is often to cut the thread of life. In these cases the best plan is to communicate the condition of the patient to his most judicious friend solely. But when an opinion is asked by a sufferer from phthisis, cancer, &c., and where there is *no* hope whatever of the patient's life being long spared, it is then a positive duty to communicate the opinion to him.

The instances in which the conscientious practitioner may feel great difficulty are cases of heart disease, since, so strong is the belief that sudden death is the termination of these affections, that great, injurious, and permanent mental anxiety will result from telling the patient of his condition. He should then communicate with some dear relative, explain the case fully, and at the same time endeavor to convince that in the majority of examples of cardiac disease death does not occur suddenly, but as Dr. Stokes insists, gives notice of its approach by long-continued symptoms of dropsy, pulmonary and hepatic disease.[1]

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[1] "Lectures on Diseases of the Heart." By P. M. Latham, M.D., vol. ii, p. 154.

[2] Watson's "Practice of Physic," third edition, vol. i, p. 114.

The prognosis includes also the secondary results of diseases, but these must be named in the descriptions of individual maladies.

SECTION VI.

THE TERMINATIONS OF DISEASE.

All diseases ultimately terminate in health or in death. Before ending in either, they may assume different forms and characters to those which they originally presented, or they may give rise to other diseases, or they may change their situation by what is termed metastasis.

Termination in Health.—This takes place in very diversified modes, according to the nature of the malady;

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[1] In a recent editorial notice of this subject in one of the medical journals (*Lancet*, March 13th, 1869), the following remarks are made by the writer: "On this question of prognosis some physicians seem to be of opinion that it is their duty to tell their patients all they know and all they think about their diseases. We entirely demur to this view of the physician's duty. It is right in the physician to be guided in giving truth to his patient by one or two considerations. First, he should consider how far his patient is capable of understanding the exact value of pathological truth. He will soon perceive that the patient is quite unable to go far in this direction, and therefore should not be troubled with too much information that is only likely to mislead him. Secondly, he should consider how far the cure of his patient will be hindered by the communication of opinions as to the most probable termination of his case. We except cases in which the tendency to death is obvious and certain. In these it is alike unkind and immoral to be otherwise than candid. In all cases it is proper for patients and physicians to consider the possibility of a bad termination of diseases; and the great duties of men, social or religious, do not depend merely upon the probable duration of life. On every ground we maintain that, in the interest of the patient, and in accordance with the growing resources of medical art, prognosis should be as cheerful and favorable as possible, and that unduly or prematurely hopeless prognosis is a violation of the first duty of the physician."

in all cases it is due to the subsidence of the morbid actions, and restoration of the vital energy. In some instances—nervous affections, for example—convalescence takes place suddenly. Most frequently, however, the change is gradual, especially in acute diseases ; a diminution in the frequency of the pulse, and particularly of the temperature, a cleaning of the tongue, and a restoration of the secretions to their normal condition, being the earliest symptoms. Often, convalescence goes on happily ; but frequently, also, it is delayed by unpleasant symptoms, such as night-sweats, loss of appetite, mental despondency, restlessness, &c. Sometimes the cure is interrupted by a return of the disease—by a *relapse*, in which the patient's position is rendered more unfavorable by the debility and unrepaired mischief remaining from the first attack.

Great importance was formerly attached, during the progress of a malady, to what were termed *crises*, or turning-points—whether favorable or unfavorable—in the disease. Critical days, critical symptoms, critical discharges, &c., were then anxiously looked for. Hippocrates designated the seventh, fourteenth, twentieth, twenty-seventh, thirty-fourth, and fortieth days as critical days. Crises are said to manifest themselves chiefly by a diminution of fever, by sweats, hemorrhages, increased flow of the secretions, eruptions on the skin, boils, carbuncles, buboes, salivation, and gangrene. The existence of critical days and critical symptoms has been denied by most modern authorities, as at least, not applying to diseases as they now exist; but recent research has shown, and the evidence is daily accumulating, that there is, at all events, a foundation of truth in these ancient doctrines ; and the practitioner would do well to remember that where relief follows from the appearance of critical symptoms, they at least show the direction in which nature is acting, and point the way in which the physician must work, in order to aid and not thwart the *vis medicatrix naturæ.* The careful investigations of Dr. Traube, of Berlin,[1] which have led him to revive the doctrine of crises and critical days in fever, are deserving the attention of the reader who wishes to learn all that can be said on this interesting subject;

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[1] "Ueber Krisen und Kritische Tage." Von Dr. L. Traube. Berlin, 1852.

and the facts worked out by Dr. Parkes and others relative to the excretion of retained products in the later stages of acute disease, as connected with "crises," are highly important as bearing upon the question.

Not unfrequently an acute disease becomes *chronic*—that is to say, the symptoms subside without disappearing, and continue for a lengthened period.

A disease may leave a particular organ, and be transferred suddenly to some other part. This is called *metastasis*—from μεθίστημι, I transfer. This change is perhaps most frequently seen in gout or rheumatism, either of which suddenly disappearing from the affected joint, may attack the head, or heart, or stomach. Another form of metastasis is apparent in cutaneous affections, when the eruption suddenly ceases, and dangerous disease is developed in internal organs. The relation of this rare occurrence is not understood. The same may also happen from the suppression of morbid secretions, of discharges from ulcers, &c., which have become necessary to the sustenance of health.

The Termination in Death.—Death is the condition to which all organized bodies must ultimately be reduced. It may take place naturally and gradually from old age—from exhaustion of the vital forces, the active powers gradually deserting each organ, the functions of absorption and secretion being arrested, the general circulation becoming slowly suspended, and the heart ceasing to contract. Unfortunately, death from mere old age is very rare.

Seeing, then, that death from disease or accident is the rule, it behooves us, as guardians of the public health, to do our utmost to remove the causes of disease, and to treat that which is unavoidable with the greatest skill and caution. Death from disease may take place in two ways—either suddenly, the transition from life to death being made in a moment, without warning—or slowly and gradually, as the termination of some lingering disorder.

The most frequent causes of these *sudden deaths* are, apoplexy; rupture of an aneurism or large bloodvessel into one of the three great cavities of the body; disease of the valves of the heart—the liability to sudden death being greater in disease of the aortic valve than in mitral valvular disease; rupture of the heart, from fatty degeneration; clotting of blood in the heart; laceration of the chordæ tendineæ; asphyxia, from obstruction of the glottis, or the bursting of purulent cysts into the air-passages; syncope, from severe shock or alarm; and injury to the head or the spinal cord. As regards the last-mentioned cause of sudden death, it must be remembered that as the phrenic nerve arises from the third, fourth, and fifth cervical nerves, so any severe injury to the cord above the origin of the third nerve will produce instant death, by suddenly paralyzing the diaphragm and intercostal muscles; while if the injury occurs below the sixth vertebra the patient may live some hours, if not days, although the action of the greater number of the intercostal muscles must be wholly or partially arrested.

In children the cause of sudden death is generally found in the lungs—ex., spasmodic croup, or laryngismus stridulus, atelectasis pulmonum, effusion into the pleura, collapse of the lung, and pulmonary apoplexy.

A large number of instances of sudden death occur annually in this country, from the different causes just enumerated.

The following table shows the deaths registered from "sudden death," from "apoplexy," and from "paralysis," occurring among the two sexes, as given in the Annual Reports of the Registrar-General for the last ten years:

Years.	SUDDEN.[1]			APOPLEXY.			PARALYSIS.		
	Male	Female	Total.	Male.	Female	Total.	Male.	Female	Total.
1858	1826	1270	3006	4325	4304	8,629	4419	4561	8,980
1859	1630	1191	2821	4284	4347	8,631	4442	4747	9,189
1860	1669	1225	2894	4445	4736	9,181	4895	4857	9,752
1861	1608	1089	2697	4283	4512	8,795	4804	5008	9.812
1862	1653	1125	2778	4452	4684	9,136	4820	4913	9,733
1863	1785	1223	3008	4925	4796	9,721	4827	4935	9,762
1864	2044	1277	3321	5152	5170	10,322	5209	5400	10,609
1865	1879	1294	3173	5054	5161	10,215	5410	5283	10,693
1866	2172	1413	3585	5121	5176	10,297	5281	5223	10,504
1867	2147	1359	3506	5223	5183	10,406	5404	5406	10,810
	18,413	12;466	30,879	47,264	48,069	95,333	49,511	50,333	99,844

The chances of dying from these three causes as represented by the facts in the table, of women as compared with men, are from sudden death as 100 to 148, from apoplexy as 100 to 98, and from paralysis as 100 to 98. It must, however, be remembered that women are more numerous than men in the general population, in the proportion of 100 to 95.

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[1] The deaths so returned include none but those sudden deaths of which the cause has not been ascertained. Many sudden deaths occur from various causes, which are classed under those causes and not as sudden deaths.

From the Supplement to the Twenty-Fifth Annual Report of the Registrar-General, it is found that the average annual rate of mortality in England from diseases of the brain is 30 per 10,000 living among males, and 25 among females; from diseases of the heart (including dropsy) the male death-rate was 11.8, and the females 13.1 per 10,000 living.

Death as it occurs in disease is usually complicated; but in all cases, whether it take place suddenly or gradually, or whatever may be the malady, it approaches through one of the three vital organs—the brain, the heart, or the lungs. Life being inseparably connected with the circulation of arterial blood, death takes place directly the action of the heart is completely arrested; and since the action of the heart is dependent upon the more or less perfect condition of all the vital organs, which stand in a peculiar reciprocal relation to each other, a cessation of the functions of either of the three speedily arrests the remaining two. Thus innervation of the muscles of respiration depends upon the medulla oblongata, the energy of the medulla oblongata upon the decarbonization of the blood, and the decarbonization of the blood upon the circulation and respiration. The force of the heart, if not directly, is indirectly connected with the medulla oblongata, because the circulation of venous blood destroys the irritability of the muscles. And so it results that failure in any one of the three links in the chain is fatal. Hence Bichat spoke correctly of death beginning at the head, at the heart, and at the lungs.

We may have then—1st, *Death by Syncope*, that form which is caused by a want of the due supply of blood to the heart. The deaths from flooding after labor, from the bursting of aneurisms, &c., are good examples of this form; on examining the heart afterwards, the cavities are found empty, or nearly so, and contracted. 2d, *Death by Asthenia*, in which there is no deficiency of the proper stimulus to the heart's action—the blood—but a total failure of the contractile power of this organ. The effects of certain poisons—as hydrocyanic acid, of strong mental emotion, of lightning, a blow on the pit of the stomach, or the head, &c.—furnish good illustrations of this form. Fatty degeneration and organic disease of the circulatory apparatus in the chest are other causes. 3d, *Death by Apnœa*—or, as we say commonly, by asphyxia or suffocation—is that which occurs when the entrance of air into the lungs is in any way stopped, as in drowning, strangulation, spasmodic closure of the rima glottidis, foreign bodies in the air-passages. It also happens when a large extent of the lungs is diseased, as in severe pleurisy with effusion, double pneumonia, and also in those cases in which the reflex functions of the medulla oblongata upon which respiration depends are suspended; in these cases death begins in the lungs. The blood being unaerated, continues venous, passes through the pulmonary veins into the left side of the heart, and thence through the arteries to all parts of the body. Venous blood, however, being unable to sustain the functions of the organs to which it is sent, its effect on the brain is at once seen by the convulsions and insensibility which ensue; the blood in the pulmonary capillaries becomes retarded, and gradually stagnates, leaving the lungs and right chambers of the heart full and distended. In what has been called *Death by Coma*, the mode of dying is really by apnœa.

CHAPTER IV.

ON THE VARIOUS CIRCUMSTANCES WHICH MODIFY DISEASE.

DISEASES vary much in their nature, severity, and duration in different individuals: being modified by age, sex, constitution, temperament, and many other circumstances of which we now propose to speak. To discriminate well the malady and the exact condition of the patient, and to regard both in the attempt to cure disease, must be the constant endeavor of the skilled practitioner. The same disease in one individual often assumes a different character in another, and requires consequently a different method of cure. We are all familiar with the fact that in typhus fever, for example, the patient will bear a very large quantity of alcohol without being affected by it, just as in tetanus and hydrophobia scarcely any amount of opium will tranquillize the nervous system. So, again, there are some few persons with constitutions so insensible to the action of mercury, that no quantity will affect their gums or increase the secretion of the salivary glands; while others, on the contrary, are so susceptible that it is scarcely possible to adminiser a grain of this metal without giving rise to its specific effects. If, then, disease or constitution so qualifies the action of these powerful agents, is it not reasonable to suppose that many conditions of the system may in like manner modify disease? And this is really the case. How often, for instance, do we see many people differently circumstanced exposed to the *same* morbid agency with a *varied* result. Thus, of half a dozen persons exposed to the same noxious influence—say that of wet and cold—one shall have rheumatism, one an attack of influenza, a third catarrh, a fourth ophthalmia, and so on. Again, a man may be exposed to the influence of some infectious disease—as small-pox—and not being predisposed to suffer from infection, may escape unharmed. Yet in a few days, nay, in a few hours, with his system depressed from fatigue, the same morbid element being encountered, he no longer escapes its influence, and the variolous poison takes root—so to speak—and produces its well-known fruit. Nature, thus apparently capricious, works according to certain general laws; and although our present knowledge may not enable us on all occasions to solve these laws, yet that they admit of solution there can be no doubt.

The following are the circumstances which chiefly modify the nature, severity, and duration of disease:

1. **Sex.**—Both sexes are equally liable to many diseases. The diseases of males are more inflammatory and more fatal on the whole than those of females. Men are peculiarly exposed to violence and accidents of all kinds, and they are more intemperate. Females, however, on account of the greater excitability of their nervous system, and owing to their possessing an organ—the uterus—whose lesions affect the whole system, are especially predisposed to nervous complaints; and such causes as give rise to inflammation in males, will in them often produce merely functional disorder. Thus gout and rheumatism often lurk unsuspected in the female system, causing dyspepsia, palpitations, uterine and neuralgic affections, without manifesting themselves more openly. It has been said that during the prevalence of epidemics women suffer less than men; which is probably to be accounted for by their more regular habits, and their being less exposed to the exciting causes of these diseases. The uterus is the active centre of sympathies, from puberty to the period of the change of life. The regular flow of the catamenia becomes essential to health, and the interruption or cessation of the discharge, except under certain circumstances, often proves the cause of great constitutional disturbance. About the age of puberty, women are apt to suffer from anæmia, chorea, and hysteria. The condition of pregnancy is favorable to health; while at the cessation of menstruation, chronic inflammations and lesions of the uterus, diseases of the breast, disorders of the colon and rectum, and cancerous affections, are likely to occur.

The practical point to remember clinically is this, that there is a greater tendency to an asthenic state in disease in women than in men.

2. **Age.**—Each of the various epochs of life is liable to certain peculiar diseases. *During the earliest period* —from birth to first dentition—not only is the body very frail, but there is great irritabllity and sensitiveness; the various parts and functions of the body are imperfectly

developed, though active growth is going on, and this is a state of things in which disorder is likely to occur in the active digestive organs, the glands, the growing bones, the developing brain—the latter is especially sensitive at an early period, as shown by a predisposition to spasms and convulsions, and to hydrocephalus, inflammation of the brain or its membranes. Mankind spring not up full-formed, and ready armed for battling with adversity, like the fabled army from the teeth of dragons sown by Cadmus; but rather as the seed which is scattered from the hand of God over all the earth.[1] As then the young plant requires care and attention proportioned to its frailness, so the tender infant demands the most constant watchfulness and judicious management. The process of dentition alone keeps up a constant irritation which impairs the functions of the brain, alimentary canal, and skin; and many children die during teething. So slender indeed is the thread of life, and so serious are the various infantile diseases, that one child in every four dies within a year after birth, and two in five before the end of the fifth year.

After the first dentition to the sixth or seventh year, the powers of life become more energetic; there is great excitement of the vascular and nervous systems, easy exhaustion, but also easy restoration. The predisposition is to inflammatory affections, to attacks of fever, and to the exanthematous disorders. In the inflammatory diseases of children there is a strong tendency to the formation of coagulable lymph, and to the exudation of false membranes upon the mucous surfaces.

After the second dentition until the age of puberty is one of the healthiest periods of life, the vital functions reacting readily upon the depressing causes of disease, and being eminently conservative in resisting noxious influences. The predisposition to the eruptive or exanthematous fevers continues, and there is also a frequent liability to epistaxis. The age of puberty is often attended with temporary constitutional derangement, especially in the female, in whom disorder of the uterine functions is common in connection with anæmia, chlorosis, hysteria, and the like.

From the age of puberty till the time when growth ceases, about 24 or 25 years of age, is a dangerous period, there being a strong predisposition to hemorrhages, tubercular disease, scrofula, and disorders of the digestive organs.

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[1] "On the Use of the Body in Relation to the Mind." By G. Moore, M.D.

After maturity there is again a period of comparative exemption from morbid tendencies, the functions being well balanced, and the actions of each organ well regulated. In females there is a tendency to disease of the reproductive system about the time of the cessation of the catamenia—from the forty-sixth to the fiftieth year ; and in both sexes, as age advances after the fiftieth year, there is decrease of strength, disturbance of certain functions, a tendency to degeneration of tissues, and loss of power in different organs. Hence there is a predisposition to various organic diseases ; the brain, heart, and the genital and urinary organs being especially prone to suffer. As senility advances sensibility decreases, the memory fails, the muscular strength becomes diminished, and gout, calculous affections, apoplexy, paralysis, softening of the brain, &c., often supervene to hasten on the period of second childhood to its close. Age has a very important influence on the same disease occurring in persons of different ages, especially beyond the middle period of life, for whenever the vitality of the body or its different parts is lessened, then nature is of course less able to cope with the disease than in young and vigorous subjects. This is well seen in fevers. The liability to sickness also increases with age.

3. **Hereditary Tendency.**—As the child often resembles the parents in form and feature, so frequently does he inherit their constitutional peculiarities, and the morbid tendencies growing out of them. It is not, generally speaking, diseases that are inherited, but only those peculiarities of structure or constitution which predispose to them. Thus children are not born with phthisis, gout, rheumatism, calculus, &c., but only with those conditions of system which favor the development of these affections when other causes co-operate. The chief hereditary diseases are scrofula, gout, consumption, epilepsy, insanity, syphilis, cancer, asthma, psoriasis, calculus. It sometimes happens, however, that the hereditary tendency is so strong, that the disease becomes developed notwithstanding the greatest efforts to prevent it, as is often seen in affections of the lungs and brain. Where there is a predisposition to disease, the time at which it

appears depends generally on the nature of the disorder. Thus the disposition to convulsions, hydrocephalus, idiocy, syphilis, and scrofula, is most apparent during the early periods of life; to epilepsy and phthisis about the age of puberty; to gout, rheumatism, and various nervous disorders, during the years of maturity; and to cancer, asthma, and paralysis, at advanced stages of life. The inheritance may proceed from one parent only, or from both. In the former case the disposition is often slight, and with care the offspring frequently escapes from any manifestation of the affection; in the latter, the chances of safety are greatly diminished. Hence the danger of intermarriages between relations, who may be supposed to have the same defects of constitution. Atavism is the term used of that form of hereditary transmission in which a family peculiarity is unobserved in an intermediate generation.

4. **Temperament and Idiosyncrasy.**—There are few individuals possessing an organization so well constituted but that they show some inequality of function, or some peculiar susceptibility, or constitutional state favoring a particular class of morbid actions. These peculiarities when affecting classes of persons are called *temperaments*, when individuals, *idiosyncrasies.* Four temperaments are generally described: (1) The *sanguine and irritable temperament*, in which the body is well nourished and the flesh firm, the complexion clear and full-blooded, the circulation is active, the pulse is full, excitement is easily produced, and the passions are strong. This temperament disposes to plethora, congestions, inflammations, hemorrhages, and fevers of an inflammatory character. (2) The *lymphatic or phlegmatic temperament*, which is characterized by a fair complexion, a pallid skin, languid circulation, softness of the muscles, and torpidity of the bodily and mental functions,—it predisposes to chronic diseases, debility, tubercular, scrofulous, and dropsical affections. (3) The *nervous temperament*, marked by a thin spare form of body, delicate features, softness of the muscles, a feeble but excitable circulation, as shown in the pulse, which is at once quickened by emotion or excitement; the cerebro-spinal system is peculiarly excitable, and the moral susceptibilities acute: it predisposes to convulsive diseases, disorders of the nervous system, insanity, and melancholia; and (4) the *bilious temperament*—characterized by well-marked features and

bodily form, firm flesh, dark complexion, good circulation, by decision of character, energy, and a capability for great physical and mental exertion—it tends to dyspepsia, hypochondriasis, and disordered action of the liver.

Sometimes, indeed generally, the temperaments are mixed, two or more existing in combination—as the *sanguineo-bilious*, when there is a tendency to inflammatory hepatic affections, to inflammations of the intestinal canal, &c.

5. **Diathesis** is the term used to designate a condition of the constitution which exhibits a strong predisposition—either hereditary or acquired—to certain diseases. The principal diatheses are, the gouty, rheumatic, cancerous, tubercular, and strumous. To refer to an illustration which we have before employed, let us suppose five or six people to be exposed to wet and cold. Of these one or two may escape without any harm, one or two may merely suffer from simple catarrh, but an individual of a rheumatic diathesis will most probably suffer from an attack of rheumatism, while pulmonary consumption may be induced in the person afflicted with the tubercular diathesis.

Patients in whom certain deposits habitually occur in the urine with corresponding constitutional disorder are often said to be of, or to suffer from, a lithic acid or phosphatic, or oxalic acid diathesis.

The relation between diathesis, temperament, and hereditary predisposition can now be readily understood. The first term signifies a constitutional disposition to certain disease; the second indicates the existence of certain general types of form and function (nutritive, circulatory, mental), observed in what may be termed healthy persons, and the latter includes any varieties of the two former, when transmitted from parent to child.

6. **Habit.**—The habits of life, mode of living and nature of occupation, are amongst the most powerful predisposing causes of—or safeguards against—disease. Habitual intemperance, *fast* or luxurious living, indolence, and excesses of all kinds, as they sap the strength and impair the health, so they increase the danger of accidents, and of serious affections; while the same effect results from the opposite extreme—from great privations, from too sedentary a life, from anxiety and distress of mind, and from over-fatiguing mental or corporeal employments. The mortality in drinkers is more

than three times as great as in the population at large. At the earlier periods of life the disproportion is still greater, being five times as great between 20 and 30, and four times as great between 30 and 50 (Guy). The intemperate bear lowering measures very badly. The habitual use of animal food in excess, especially when a counterbalancing amount of exercise is not taken, predisposes to inflammatory affections, to disorders of the primæ viæ, to gout, apoplexy, &c. A vegetable diet, on the contrary, leads to impoverishment of the blood, and its attendant diseases. Alcoholic drinks too freely employed, frequently excite plethora, paralysis, delirium tremens, and dropsy, while pulmonary disease, epilepsy, and insanity often result from inordinate sexual intercourse. All these vitiated habits, moreover, by depressing the powers of life, predispose the system to receive any epidemic or infectious poison that may be prevalent, and to which it may be accidentally exposed; while, by lowering the conservative powers of nature, the constitution is less able to bear up against the resulting diseases when developed. Luxury of all kinds tends to lower the tone of the system and to impair its functions.

The want of personal cleanliness is a source of much ill-health and pulmonary disease. Miners, stonemasons, cutlers, and the like, by the inhalation of particles of dust, metal, soot, &c., are liable to lung disease.

In some instances the influence of habit is salutary, as we see in persons who become acclimated in malarious or otherwise unhealthy districts, and in those whose sensibility to cold and wet is blunted by habitual exposure. In the same way many systems become reconciled to the habitual use of certain classes of poisons—probably those only which are derived from the vegetable kingdom—as tobacco, opium, and alcohol, which even become sources of enjoyment, and apparently, to a certain extent, of health.

7. Climate and Temperature.—The influence of climate and temperature over disease, either in promoting, modifying, or alleviating it, is now generally admitted by all practitioners of medicine. Climate is of course made up of the elements of temperature, moisture, varying pressure of the atmosphere, soil, and physical conformation of a country.

The range of atmospheric temperature compatible with life is very extensive. Gibbon—after stating that the Roman soldiers, from their excellent discipline, maintained health and vigor in all climates—adds, that "man is the only animal which can live and multiply in every country, from the equator to the poles." Man is much indebted to the ingenuity of his mind in raising up numerous barriers to protect his constitution from the deleterious effects of extreme heat or cold. This fact is at least certain, that a mode of living essential to health in the northern regions, will prove rapidly destructive at the equator, and *vice versâ;* though it is worthy of notice that greater care is necessary to preserve life under very great cold than under intense heat.

Extremes of heat or cold are better borne than any sudden change in temperature, though such changes are by no means so destructive to health as is commonly imagined. A curious instance of inconvenience from a rise in temperature is related by Captain Parry, who says that when in the Arctic regions the thermometer suddenly rose from 13° below zero to 23°, or 9° below the freezing-point—every one complained of the temperature being much too high to be agreeable.

Some interesting remarks are made in reference to the cold against which man can become proof by Dr. Hartwig,[1] in his work on the "Polar Regions." Whilst Kane, in 1854, was wintering in Smith's Sound (70° 37′ N. lat.) the mean of his spirit-thermometer was —68°, or 100° below the freezing-point, when chloric ether became solid. The air had a perceptible pungency upon inspiration, and every one as it were involuntarily breathed guardedly, with compressed lips. Sir E. Belcher experienced a cold of —62° in Northumberland Sound in 1853. The average temperature in winter-time beyond the Arctic circle, and eight or ten degrees farther south in the interior of the continents of Asia and America, ranges from —20° to —30°. A thick fur clothing, a hut small and low, where the warmth of a fire, or simply a train-oil lamp is husbanded in a narrow space, and, above all, the wonderful power of the human constitution to accommodate itself to every change of climate, go far to counteract the rigor of the cold. One of Kane's party so inured himself to the cold, that he slept on sledge journeys without a blanket or any other covering than his walking-suit, though the outside temperature was —30° F. Dr. Hartwig remarks that "after a few days the body develops an increasing warmth; for the air being condensed by the cold, the lungs inhale at every breath a greater quantity of oxygen, which of course accelerates the internal process of combustion, whilst at the same time an increasing appetite, gratified with a copious supply of animal food, of flesh and fat, enriches the blood, and enables it to circulate more vigorously." Scurvy is one of the most frequent diseases of cold climates, but this is due to the latter only indirectly, its immediate cause being an imperfect diet, especially a deficiency of fresh vegetable food. The influence of climate in consumption is a matter of supreme importance. It has until recently been considered that a warm southern climate is good for consumption. Dr. Hermann Weber has collected a large amount of evidence to show that high and dry and cold regions are also curative. A curious instance of immunity from consumption is found along the shores of the Hebrides; and Dr. McNab, who has published a pamphlet on this subject, believes that the cause is to be found in the large amount of seaweed which abounds, giving off an abundant amount of iodine to the atmosphere.

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[1] See the "Polar World." By Dr. G. Hartwig. Longmans. 1869.

The first effect of *extreme heat* is on the organic functions of the body, which become greatly stimulated, while the animal functions are depressed. The action of the heart becomes accelerated, the pulse increases in frequency, the biliary secretion is augmented—but deteriorated—and the skin perspires freely. On the other hand, there is nervous depression, with languor, lassitude, and an incapacity for mental or bodily exertion.

The ill effects upon Europeans of residence in tropical climates—where the thermometer often ranges from 80° to 100°, or even 110° Fahr., or higher[1]—are soon seen in the liver, causing an increase in the biliary secretion; this gland being maintained in a state of undue excitement, both from the stimulating influence of the heat, and the additional duty which it has to perform in the elimination of carbon. Hence, as occurs in every organ stimulated to undue action—one of two things occurs. Either—the cause being constant and long maintained—serious injury accrues to the organ itself, generally to the extent of structural alteration ; or—the cause being only temporary—torpor or exhaustion of the gland takes place, and in the performance of its functions it falls short of the healthy standard ; in either case producing great constitutional disturbance. Another primary effect of a hot climate is seen on the cutaneous surface, in promoting perspiration, and also in giving rise to a morbid condition—attended with pricking, tingling, and itching sensations—in which the skin is generally covered with an eruption of vivid red pimples. This disease, known as the prickly heat—lichen tropicus—makes a tropical life for a time miserable, since it causes irritation at the most unseasonable hours, for weeks together.[1]

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[1] The mean temperature of the London atmosphere is 50½° Fahr.

The *coup de soleil*, or sun-stroke, not uncommonly affects individuals exposed to the direct beams of a hot sun, causing insensibility and frequently death. Examples of it are abundantly seen among the troops during long marches in India.

The effects of *extreme cold*, when this plays unchecked upon man, are first shown in causing depression of the organic functions, as is seen in the dwarfish size of men and animals in cold regions, the shrinking of external parts, the diminished cutaneous circulation, the contraction of the skin around the hair-bulbs and sebaceous follicles—producing the peculiar appearance known as *cutis anserina*—and in the diminished power of the sexual organs. Long and unprotected exposure to extreme cold gives rise to torpor of the nervous system, confusion of the intellect, a staggering gait resembling that from drunkenness, and to an overpowering desire for sleep, which, if indulged, almost inevitably proves fatal. Cold proves more injurious, and is less easily borne, when applied by a wind or current of air, as well as when accompanied by moisture, than when the atmosphere is dry and at rest. Diseases of the pulmonary organs and scurvy are the most common affections of cold climates.

In *temperate latitudes* there is a less exclusive tendency to disease of any special organ than in climates nearer the poles or equator ; although owing to the sudden vicissitudes of temperature, the frequency of cold winds, and of moisture, there appears to be a morbid tendency to typhus and typhoid and intermittent fevers, consumption, inflammatory, rheumatic, and catarrhal affections. In our country the winter months (December, January, and February) show the greatest fatality from disease, and the temperate months (April, May, and October) the least amount of fatal disease. Pneumonia and bronchitis specially occur amongst young and old in the cold, and diarrhœa, cholera, dysentery, and fever, amongst the population in the summer months.

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[1] Johnson and Martin on "Tropical Climates."

Moisture of Atmosphere.—One of the chief things that influence disease is certainly the degree of moisture of an atmosphere, and this is closely associated with the temperature and the character of the soil and the physical conformation of a country. In low-lying localities in our own country which have a damp atmosphere, ague, and rheumatism and consumption are to be found; and recent researches, especially those of Dr. Buchanan in this country, and Dr. Bowditch, of America, have shown that there exists a direct connection between dampness of soil and the prevalence of consumption.[1] Dr. Buchanan found that of late consumption has diminished largely in some places—to the extent of fifty per cent. in Salisbury—and the reduction coincides with one kind of change, and one only—diminution of subsoil water. In his inquiry he noticed that populations might have become less crowded, might be living under cleanlier conditions, might be drinking purer water, or might be getting rid more completely of their excreta, and yet there was no constancy in the change, if change there were, that had been made in the death-rate from consumption, unless the amount of subsoil water had diminished. This decrease in subsoil water has been in many towns produced by the drainage works which have been largely executed throughout the country of late. The relation of consumption and wetness of soil is an important matter, as indicating in what way consumption may be prevented or its cure assisted. In the tropics a high temperature and moisture are present together, and aid, in marshy districts, the genesis of yellow fever, cholera, dysentery, intermittent and remittent fevers, and diarrhœa.

Impurity of Air.—This condition has great influence on disease. The contamination of the atmosphere in over-crowded places and rooms, the emanations from drains and sewers, from refuse animal matter, from manufactories, from decomposing vegetable matter, and the like, prevent of course the breathing of pure air, and induce general debility and a condition in which disease cannot be resisted, and recovery from illness becomes difficult. The emanations from sewers and closets, entering a house, may produce typhoid fever in the inmates.

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[1] See Tenth Report of the Medical Officer of the Privy Council.

CHAPTER V.

ON THE SYMPTOMS AND SIGNS OF DISEASE.

WITHOUT a correct knowledge of symptomatology or semeiology—the science which treats of the symptoms and signs of disease—we can know but little of the art of medicine; since a thorough acquaintance with the structural and functional disorders to which the human body is liable, essentially comprises a recognition of existing symptoms and signs, a proper appreciation of their value, source, antecedents, causes, relations, and connections with each other, and the results which may be expected to flow from them singly or in combination. The importance of carefully studying the symptoms, therefore can hardly be over-estimated, for from them we form our diagnosis and prognosis, and learn in what direction to conduct the treatment. It follows necessarily that he will prove the best physician who is the most sagacious in observing them, and in deciphering their import and true value.

What, then, it may be asked, is a symptom? I cannot do better than reply in the words of Sir T. Watson, who says—"Everything or circumstance happening in the body of a sick person, and capable of being perceived by himself or by others, which can be made to assist our judgment concerning the seat or the nature of his disease, its probable course and termination, or its proper treatment: every such thing or circumstance is a symptom."[1] It thus appears that *symptoms* are obvious to all persons alike, to the educated as to the uneducated, in this respect differing from the *signs* of disease, which are, generally speaking, intelligible to the medical eye alone. Signs indeed are, for the most part, deduced from symptoms, either from one symptom or from a combination. Thus cough is a symptom of many laryngeal and thoracic affections; but combined with a hooping noise during inspiration it becomes a sign. Symptoms have been aptly compared to words taken separately or put together at random; arranged in due order, or put together in sentences, they convey a meaning, they become signs.

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[1] Op. cit., vol. i, p. 111.

Various divisions of symptoms have been made, which are neither very philosophical nor of much practical utility. It is necessary to mention, however, that authors speak of symptoms as *local*, *general*, or *constitutional;* as *idiopathic*, when proceeding directly from a primary disease; *symptomatic* or *secondary*, when due to secondary disorders, or those produced by the primary affection; *premonitory* or *precursory*, or symptoms which indicate an approaching disease; of symptoms which are *diagnostic*, since they enable us to distinguish disorders which might otherwise be confounded; or of those which are *prognostic*, because they denote the probable issue of a case; or *therapeutic*, since they indicate the treatment. Moreover, those diagnostic symptoms which are peculiar to one disease are called *pathognomonic* or *pathognostic*. Symptoms are also *subjective* or *objective:* subjective if they are appreciable by the patient, and through him and his description to the physician; objective when the physician can himself observe and recognize the change for himself without the aid of the patient. When authors speak of *physical signs*, they allude to those phenomena dependent upon a change in the properties of the body or any of its parts, which are made out by mensuration, auscultation, palpation, and the like; when of *vital symptoms*, to such as depend on the vital properties of a part or parts of the body, as irritability, tonicity, sensibility, &c.

It may almost appear unnecessary to mention that in the study of semeiology every circumstance which is at all characteristic is important; and that the form and violence of the symptoms, the particular order in which they appear, and the manner in which these signals of disease are conjoined, merit especial attention. The clinical history of a disease is made up of the symptoms and signs that occur in it.

We will now proceed to the proper subject-matter of this chapter, according to the following arrangement: 1, the symptoms and signs afforded by the countenance, and the general appearance and condition of the body; 2, those symptoms and signs belonging to the organs and function of digestion; 3, those belonging to the function of respiration; 4, those belonging to the function of circulation; 5, those connected with the urinary and sexual organs; and 6, those derived from the nervous system.

SECTION I.

SYMPTOMS AND SIGNS AFFORDED BY THE COUNTENANCE, AND THE GENERAL APPEARANCE AND CONDITION OF THE BODY.

The manifestations of disease which have to be considered in this section are those derived from the expression of the countenance, from the eye and the function of vision, from the sense of hearing, and from the posture, and the general condition of the body.

The Expression of the Countenance.—The facial expression is of importance in the recognition, diagnosis, and prognosis of most maladies, but especially perhaps in those of young children.

When the *general expression* of the countenance is serene, tranquil, and steady, or expressive of hope, it may generally be regarded as of favorable import in disease, especially if such expression supervene gradually on the disappearance of restlessness and acute symptoms generally: it must be remembered, however, that it may be—though it is so rarely—an unfavorable sign, as when it occurs suddenly during the progress of severe organic disease on the unexpected cessation of pain. In chronic disorders, unattended with pain or suffering, and in the latent stages of fever, the countenance is often indifferent, the look is partly fixed, and the eyes bright. In the later stages of fevers, however, the movements of the lips are tremulous, and the lips themselves are covered with sordes and with a brown or black coating, like that on the teeth and tongue. Immobility of the features may generally be looked upon as a sign of debility, or a loss of consciousness, or of general tonic spasm—as catalepsy.

Anxiety and pain produce a characteristic change in the features. At the commencement of acute diseases generally, in spasmodic affections, asthma, angina pectoris, &c, in inflammations of important viscera, in disorders of the generative organs, and in hypochondriasis, the countenance assumes an anxious air; a peculiar mixed expression of anxiety and resignation is also common in organic diseases of the heart, and of the great vessels. The expression of terror or of great fear is observed chiefly in hydrophobia, in certain forms of insanity, during or after hemorrhages, and after accidents; the expression in delirium tremens indicates suspicion. So the expression of rage occurs for the most part in inflammation of the brain, in hydrophobia, and in insanity. A bashful, downcast countenance, with inability to look one manfully in the face, is generally a sign of nervous exhaustion from masturbation, and often of impotency. That peculiar cast of countenance termed the *Hippocratic*, which forebodes death, is thus described by Hippocrates: "The forehead wrinkled and dry; the eye sunken; the nose pointed, and bordered with a violet or black circle; the temples sunken, hollow, and retired; the ears sticking up; the lips hanging down; the cheeks sunken; the chin wrinkled and hard; the color of the skin leaden or violet; the hairs of the nose and eyelashes sprinkled with a yellowish-white dust." Such is the alteration in the human physiognomy which usually precedes death, or which may be produced by intense anxiety, grief, or sudden fright, or by long-continued want of sleep; in all cases it renders the prognosis very unfavorable.

Marked elevation and expression of the *alæ nasi* in children indicates the presence of grave lung mischief of an inflammatory character.

But of all the appearances presented by the countenance, that caused by *facial paralysis* is the most striking and peculiar, since from one-half of the face all power of expression is gone; the features are blank, still, and unmeaning; the paralyzed cheek hangs loose and flaccid; and the face is drawn on one side, the healthy side being that so drawn, owing to the action of the sound muscles not being counterbalanced by the play of those on the affected side. Facial paralysis may indicate brain disease when it is attended by other grave symptoms, or it may indicate that the trunk of the nerve away from the skull or brain is affected. Happily, however, there is not in the greater number of cases any cause for real alarm; protracted cold, or some external injury or wound to the facial nerve—the portio durǎ of the seventh pair—or pressure upon this nerve by an enlarged parotid gland, being often the exciting cause of the complaint. In slight cases of hemiplegia the face is often unaffected, the paralysis being confined to the upper and lower extremities of one side: sometimes, on the contrary, however, the face is the part first affected, the motor portion of the fifth nerve being more or less involved in, or influenced by, the paralyzing lesion. In such cases, the motions of the jaw on the affected side are impaired, and mastication is impeded; but unless the portio dura is also involved, there is little or no distortion of the features, and no loss of expression. The disease of the motor portion of the fifth pair may be seated in or near the origin of the nerve in the brain, or, more rarely and more favorably, in the course of the nerve; when there is loss of sensibility also, the sensitive branches of the fifth pair are likewise implicated.

The appearance of the *lips and mouth* alone, often gives valuable aid in diagnosis. Thus, retraction of the corners of the mouth, so as to produce the sardonic grin—risus sardonicus—is very remarkable in inflammation of the diaphragm, and in certain painful affections of the stomach and bowels. So in the last stage of phthisis, or of hectic from exhausting diseases, or of cancer, the thin, retracted appearance of the lips, as if they were stretched over the gums, is peculiar. Swelling of the lips often occurs in children suffering from intestinal worms, and in incipient phthisis; in strumous subjects the upper lip is generally enlarged. After hemorrhage, in anæmia, and in diseases of the uterine organs, the lips are pallid, and at the same time inclined to crack and become sore; so, on the contrary, they present a purple hue, when, from any cause, the blood is imperfectly arterialized, and when there is congestion of the thoracic viscera. Indolent fissuring at the angle of the mouth is suspicious of syphilitic disease.

The *hue or color* of the countenance should be noticed. A pallid or anæmic tint attends all diseases caused by, or giving rise to, poverty or thinness of the blood, with a deficiency of the red corpuscles, as in Bright's disease; a generally diffused redness of the face attends inflammatory fevers in the early stages; a dark, murky tint shows a morbid condition of the circulating fluids. In secondary syphilis there is often a peculiar earthiness of the complexion; a continued sallowness or jaundice is common in diseases of the liver, as well as in diseases of the spleen; a blue, leaden tint is seen in cases of malignant cholera; while the face becomes livid in obstructive diseases of the heart or great vessels, in general acute bronchitis, in the last stage of pneumonia, and in congestion of the lungs.

A dark circle under and around the eyes is often observed in females suffering from ovarian or uterine disorder, menorrhagia, prolonged leucorrhœa, or who practice masturbation. It is not uncommonly present also in connection with severe organic diseases, especially perhaps when they are of a malignant character, and in some cases of anæmia.

Puffiness or œdema of the eyelids is frequently seen in the early stages of dropsy, dependent upon cardiac or renal disease; *closing of the eyelids* takes place from intolerance of light, vertigo, or swelling; *a falling of the upper lid*—ptosis—caused by paralysis of the third nerve, may be due to merely local causes, as rheumatism, injury, &c.—or it may be the consequence of cerebral disease, as apoplexy, concussion of the brain, tubercular meningitis—and so on,—or it may be the precursor of an attack of hemiplegia; and lastly, *a frequent tremulous movement of the lids* is observed in chorea, epilepsy, hysteria, and in catalepsy towards the end of the paroxysm.

Signs presented by the Eye.—We must leave out of consideration the diseases of the eye proper, and refer only to those which are connected with general disorders. The eye may be increased in *size* from hyperæmia of its tissues, such as takes place in impending suffocation, or in congestion of the brain, heart, or lungs; in medullary cancer the eye becomes extruded from the cavity of the orbit as the disease advances; its *position* may be altered so that it becomes more prominent, and therefore apparently increased in size, in convulsions, apoplexy, epilepsy, delirium tremens, and exophthalmic goitre. In the last-mentioned disease, the projection is very marked, the patient having a peculiar wild and staring look.

Protrusion may also occur from tumors developed behind it, from inflammation and turgidity of the surrounding tissues, from enlargements of the lachrymal gland, from aneurism, exostosis, or disease of the periosteum. Sinking of the eye is, on the contrary, a sign of atrophy of the parts behind the eyeball, and is seen in phthisis, in malignant and all wasting diseases, after long fasting, or hemorrhages, or violent evacuations, and fevers. As a rule, both eyes are equally sunken; if only one be so, some local affection of the brain, or paralysis of the optic nerve, is the probable cause.

The *color* of the eye should not be disregarded. Redness of the conjunctiva is a symptom of local inflammations, and also of congestion or inflammation of the brain or its membranes.

Sclerotitis is generally due to injury, or to severe catarrh, but may occur in subjects predisposed to, or suffering from, rheumatism. Iritis is often a clue to the rheumatic or the syphilitic diathesis.

The circumference of the cornea often undergoes a remarkable change in individuals about the age of forty-five or fifty—it is very rare before middle age—when, instead of presenting that translucent appearance so characteristic of its perfect state, it loses its lustre, and becomes opaque. This change, so well known as the *arcus senilis*, comes on gradually, without pain, and without giving rise to any loss of function; it also occurs simultaneously in both eyes, except in cases where local disease or injury may have materially impaired the nutrition of only one organ. We are indebted to Mr. Canton for the discovery that this senile arc is due to fatty degeneration of the edge of the cornea, and for the doctrine that it may be regarded as indicating a similar state of decay in important internal viscera, as the heart, the liver, the kidney, the muscles, the coats of the small bloodvessels of the brain, lungs, &c. The extent of degeneracy has appeared to him to bear a relation to the degree to which the cornea was invaded by the deposit. This statement must be received with some reservation, but that it approximates rather closely to the truth most practitioners allow. If in addition to the arcus senilis the pulse be feeble and slow—below fifty, and if the affected individual suffers also from repeated attacks of syncope, fatty degeneration of the muscular fibres of the heart is *likely* to be present.

The *size of the pupil* possesses some diagnostic importance. A contracted pupil is often a sign of brain irritation, and is observed in congestion of the brain, in inflammation of this organ or of its membranes, in some unfavorable cases of apoplexy and epilepsy, in hydrocephalus, in inflammation of the retina, and in poisoning by opium and Calabar bean. A dilated pupil—when not due to an obstruction to the entrance of the rays of light, as by cataract or other causes—is indicative of some disease of the brain without much irritation in connection with effusion and pressure, as apoplexy, the advanced stage of hydrocephalus, &c.; or of some sympathetic cerebral disturbance from gastric or intestinal irritation; or of amaurosis; or of the action of belladonna, or a poison of the same class. When, during the progress of any cerebral affection, dilatation follows rapidly upon contraction of the pupil, the occurrence of effusion, or some organic change, is to be feared, especially if only one pupil be so affected. Contraction or dilatation in one pupil alone, unless traced to local causes distinctly, is a sign of cerebral mischief. Insensibility of the cornea is a sign of coma.

The *lustre* of the eye is generally diminished at the commencement of acute diseases, in all infectious and pestilential maladies, after exhaustion from any cause, and in all affections where the nervous system is greatly debilitated. It is increased in the early stage of cerebral inflammation, in delirium, and in many forms of insanity, especially acute mania. A glazed appearance of the eyes is common before death.

The *function of vision* is early affected in some disorders. Photophobia—increased sensibility to light—is observed in diseases where the sensibility generally is exalted, as hysteria; in irritation or inflammation of the brain; in inflammation of the different textures of the eye; and in scrofula. In commencing diseases of the brain, or of the optic nerve (leading to amaurosis), one of the earliest symptoms is general indistinctness of vision—amblyopia; or objects appear double—diplopia; or only one-half of a figure can be distinguished at a time—hemiopia. In the same cases, scintillations, or sparks or flashes of fire—photopsia—are seen; or the patient complains of dark spots, or black figures, or flies—muscæ volitantes—floating in the air, but the latter are also seen in subjects who are dyspeptic and the subjects of liver disorders.

Squinting, when congenital or acquired by habit, is of no importance as regards diagnosis or prognosis; but when it occurs in cerebral inflammation, apoplexy, or indeed in the course of any disease of the brain, it must be regarded as of very unfavorable import. In paralysis of the third nerve—and this, it may be observed, is often a precursor of hemiplegia—there is generally, in addition to a falling of the upper eyelid, squinting of the eyeball outwards.

Ophthalmoscopic Appearances in General Diseases.—Since the discovery of the ophthalmoscope it has been found that the appearances of the back of the eye are liable to change in various cerebral and spinal disorders.

It has long been known that loss of sight was far from rare in meningitis, hydrocephalus, cerebral tumor, &c., but since the back of the eye has been laid bare for minute observations, it has been found that changes in the optic nerve and retina coincide very frequently with cerebro-spinal disorders, even when there is no perceptible or no important loss of visual power.

It has been thought therefore, that the ophthalmoscope may give the same kind of help in the diagnosis of diseases within the nervous cavities, that the stethoscope gives in diagnosis of intra-thoracic changes. Dr. Hughlings Jackson and Dr. Clifford Allbutt have made a special study of this subject in England, and like investigations are being made in France by Liebreich, Galezowski, and Bouchut, and in Germany by Gräfe. It seems from the results of these observations that ophthalmoscopy may be of very great assistance in the discovery of cerebro-spinal disease, and in some obscure cases may be actually decisive. It is probable also that the changes observed in the optic nerve may throw a good deal of light upon the pathology of nervous diseases. Our space will not allow us now to enter into any details upon this important subject; we shall give a few practical hints to students, and refer the reader to Dr. Hughlings Jackson's papers in the *Royal Ophth. Hosp. Reports*, vol. iv, *Brit. Med. Journ.*, March 28, 1868, and to papers by Dr. Clifford Allbutt in the *Med.-Chirurg. Review* for Jan., 1868, in the *Med. Times and Gazette* for June, July, and August, 1868, in the *Lancet* for May 1st and May 8th, 1869,[1] and in the *Medico-Chirurgical Transactions*, vol. li. The symptomatic changes in the eye are almost entirely confined to the optic nerve entrance with the belt of retina immediately surrounding it, and to the retinal vessels. The optic nerve entrance, called the optic disc, consists of the central vessels, which enter here; the sheath of connective tissue in which they are imbedded, the nerve tubules which are supported by an elaborate framework of the same tissue; and of the neurilemma. The central vessels, the arteries and veins with their branches, are liable to increase and diminution in diameter, to varicosity, and even to rupture. As the vessels pass through the unyielding sclerotic ring with the optic nerve, they are liable to strangulation when distended, and then become very full, tortuous and dark. Effusion too quickly follows in these cases, dimming the surface and outlines of the swollen disc and retina. This condition, first clearly pointed out by Gräfe, and distinguished by Dr. Allbutt as the strangulated or ischæmic disc, is soon set up when any pressure upon the bloodvessels behind the orbit arrests the reflux of venous blood. Effusion at the base of the brain, and tumors of the brain or its membranes, by pressure upon the cavernous sinus, frequently cause this arrest, and so reveal their presence to the mirror. The extreme degrees of this hyperæmia are easy to detect; in its lesser degree, however, it can only be certainly ascertained by practised observers. It seems likely from the interesting observations of Dr. H. Jackson upon the disc during sleep, that the varying quantities of blood in the brain may to some extent be represented by like variations in the vascularity of the retina. Dr. Allbutt has also pointed out in his papers on meningitis in the *Lancet* (loc. cit.), that chronic and obscure meningitis may frequently occur, without giving rise to any unmistakable symptoms. Such forms of meningitis he has often detected by means of the mirror. Cerebral tumors again constantly give rise to extreme hyperæmia of the discs, and may be detected by the mirror before any definite symptoms supervene, or when such symptoms as pain or vomiting are of uncertain meaning. There is another very important change again to which the optic nerve and its disc are liable, and that is "optic neuritis." This process, which is one of inflammation with hyperæmia and active proliferation, creeps down the nerve and appears in the disc and the surrounding zone of retina. This neuritis or circumscribed neuro-retinitis is a common consequence and an important sign of meningitis and of cerebral tumor. It very constantly, or almost invariably occurs in syphilitic disease of the brain and membranes. The appearances in optic neuritis are well described in all recent works on diseases of the eye, and consist chiefly of swelling of the nerve with hyperæmia, and more or less opaque exudations. Minute hemorrhages frequently accompany optic neuritis, but larger hemorrhages are chiefly confined to a form of retinitis which often coincides with diseased cerebral vessels, but which belongs more directly to Bright's disease.

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[1] It is understood that Dr. Allbutt is preparing a volume for the press which will deal fully with the subject of Medical Ophthalmoscopy.

We must speak of one more very important optic change—viz., atrophy of the nerve and disc. In this state we find the nerve degenerated and the vessels of the disc shrunken. The central vessels may remain almost unchanged. The disc becomes much condensed by increase of its connective tissue and choking of the nervous elements (sclerosis); this, with the absence of blood, gives it a staring, white, and glistening appearance. This atrophy may be primary, or it may follow neuritis. In the latter case the ragged edges of the disc show traces of the past disturbance. Atrophy may be due to any cause pressing upon the nerve or severing its continuity within the orbit or skull. It is often due to local neuritis cutting the nerve across, but not creeping down to the eye. Again, it is often due to, and very significant of, the pressure of tumor, or of meningitis. When consequent upon neuritis, its causes are of course the same as the neuritis. Among the less frequent causes of optic changes are abscess of the brain, softening, and old hemorrhages "acting as foreign bodies." It is a very curious fact that optic atrophy is frequently due also to spinal disease, especially to degenerative disease of the posterior columns. Dr. Allbutt has recently shown too (*Medico-Chirurgical Transactions*, loc. cit.), that it constantly occurs in general paralysis. It is important to remember that all these changes, and ischæmia and neuritis especially, may, and frequently do, exist without any disturbance of central vision.

Nephritic Retinitis.—In Bright's disease the vision may be disturbed in two ways: first of all there may be a serious loss of vision, amounting almost to blindness, which is unattended by any apparent changes in the eye, but which is attended by symptoms of uræmia, such as headache, vomiting, convulsive attacks, and the like, and is probably dependent upon some disturbance of the cerebral centres of vision.

In the other form the blindness depends upon obvious and very remarkable changes in the retina—viz., on a particular form of diffused retinitis. This retinitis need not, and often is not attended by any uræmic symptoms, but may exist without any other nephritic symptoms, or be in some cases indeed the first reason for any suspicions of albuminuria. The blindness may appear somewhat suddenly, but it generally creeps on slowly. The retinitis chiefly affects the region of the disc and yellow spot, and seldom or never involves the whole retina. It never causes, therefore, complete blindness. It often ends in atrophy of large tracts of the retina, with permanent amblyopia. Sometimes it clears up, and leaves the retina again capable of its function. The affection is seen first of all in an intense and dark hyperæmia surrounding and involving the disc, and this stage may terminate in resolution and recovery, though but rarely. If it proceeds, we see in the next place, grayish or yellowish-white patches of degenerated retina, chiefly scattered about the yellow spot. Minute hemorrhages also occur, sometimes in great abundance. In a farther stage these patches coalesce by extension, and, on account of the exudation within them, become very prominent, as does the inflamed disc also, so that in some cases the lumpy disc is surrounded by a wall of fatty deposits and exudations. Sooner or later these products are reabsorbed, and atrophy of the retina remains. With the microscope the vessels are generally found to be much diseased and thickened, the connective tissue has actively proliferated, giving birth to degraded elements, and the proper nerve-tissues of the retina are degenerated, and form oil-globules, colloid masses, &c.

This retinitis in the large majority of cases accompanies the small rough, or so-called gouty kidney. It has been seen, however, in amyloid disease of the kidneys (Traube, Beckmann), in scarlatinal nephritis, and in the large, smooth kidney of chronic tubular nephritis (Allbutt). It was supposed, at any rate the hemorrhagic events of it have been supposed, to be due to the hypertrophy of the heart with vascular tension, but Dr. Allbutt tells us that he has seen Bright's retinitis in cases where there certainly was no cardiac hypertrophy. He is also indisposed to think that the retinitis is due to general disease of the vessels, as mere arterial degeneration should lead rather to simple atrophy of the retinal structure, and moreover the state of the vessels is very like that which is also seen in other forms of retinitis not associated with diseased kidneys, vessels, or heart.

The Sense of Hearing.—Preternatural acuteness of the sense of hearing sometimes precedes delirium and affections of a spasmodic character, especially epilepsy and tetanus; when it occurs during the progress of severe diseases, the prognosis is rendered suspicious, to say the least. The opposite fault—obtuseness of hearing—is more common, and generally of less significance; when it occurs in continued fever, in the exanthemata, &c., as it often does, it is not a symptom of much moment. With the deafness depending upon some physical imperfection in the organ of hearing, the physician has but little concern; it is only in instances in which it has a deeper origin that his attention is excited. In organic cerebral diseases especially, the occurrence of deafness must be regarded as an unfavorable sign; such is also the case in concussion of the brain, and in epilepsy.

A depravation of the sense of hearing, consisting of peculiar ringing noises in the ears—tinnitus aurium—often results simply from excitement of the imagination, and from too strong throbbing of the arteries about the temple; congestion of the cerebral vessels and morbid states of the brain of every kind will also produce it. When more or less constant, and of course supposing it to be independent of disease of the ear or closure of the Eustachian tube, it has been regarded as a sign of degeneration of the vessels of the head, and it may then prove the precursor of apoplexy, or paralysis, or—more fortunately—merely of epistaxis. Phenomena of a similar kind are often complained of by aged persons of both sexes who omit taking exercise in the open air; and by women suffering from nervous exhaustion, anæmia, or disease of the uterine organs. These annoying sounds are variously compared to the rushing of the wind, the hissing or singing of a tea-kettle, the beat of a drum, &c.

The Posture and General Condition of the Body.—Inability to stand results from weakness in a great number of acute and chronic diseases. It may, however, be the consequence of disease of the joints or bones of the lower extremities, or of paralysis, or of vertigo, as at the commencement of many acute fevers. Inability to lie down—the necessity of assuming the sitting attitude—is an important indication in many disorders of the thoracic viscera. It is often hardly possible to relinquish the sitting position in simple dyspnœa, asthma, severe bronchitis, advanced phthisis, pleurisy with copious effusion, pneumonia, and in many instances of organic disease of the heart. In less urgent examples of these affections the sufferer obtains ease in a semi-supine posture, the shoulders and head being elevated by pillows. In extreme cases of asthma, the patient is often obliged to lean forwards and place his elbows or arms on the window-ledge, in order to procure a fixed point for a stronger contraction of the muscles of respiration.

A constantly-retained position on the back is common in low fevers, and in the low stage of acute maladies, when the vital powers are thoroughly exhausted; there is often at the same time unconsciousness, or coma, or low muttering delirium, indicating extreme exhaustion of organic nervous power. When this position is long retained, great attention to cleanliness, and a water-bed or cushion, will be required, to prevent ulceration and gangrene of the skin over those parts of the back most pressed upon.

The supine position, with the knees drawn up, so as to relax the abdominal integuments, indicates peritonitis, or less frequently, inflammation of some of the viscera within the abdomen. Lying on the abdomen, and tossing from the prone to the supine posture, is observed in severe colic, during the passage of gall-stones, &c.

A quiet position in lying down, with perfect consciousness and strength, is a favorable sign in disease, showing that the morbid processes are terminating. In acute rheumatism, however, the patients lie quiet, owing to the pain caused by any movement. A restless mode of lying down yields an unfavorable prognosis in thoracic inflammations, in rheumatism, and in most organic diseases. Lying on the right side is often preferred in health, and especially in pneumonia of the right lung, or in pleurisy with effusion of the same side, after the acute and more painful symptoms have subsided. Patients wish to lie on the left side in many organic diseases of the heart, sometimes in aneurism of the thoracic aorta, and in pneumonia or pleurisy of this side with effusion, after the pain has ceased. In the early stages of pleurisy of either side the affected person mostly lies on his back, with an inclination perhaps towards the affected side.

The *nutrition of the body* should always attract attention. When there is emaciation, and it is rapidly increasing in degree, we may feel certain of the existence of severe constitutional disorder. In organic diseases of the lungs, heart, or digestive organs, emaciation is always present; so also in those affections attended with morbid discharges, as well as in low, continued, remittent, and hectic fevers. A redundant flow of milk—galactia—in women who are suckling, will give rise to wasting. When some of the secretions are so increased as to be exhausting, they are spoken of as colliquative, as colliquative sweats, colliquative diuresis, &c. Arrest of the progress of emaciation, and a more or less marked restoration of the flesh, is always a very favorable symptom, especially if at the same time there be an increase in strength. A sudden tendency to become corpulent, without any change in the habits and mode of living, must be viewed with some suspicion, such tendency being often a forerunner of apoplexy. Care must be taken not to confound increased size, occasioned by the deposition of fat, with serous infiltration and emphysema.

Serous infiltration of the face and of the upper extremities is a result of disease of the heart or lungs, rather than of the abdominal viscera, although one of the earliest circumstances which attracts attention in Bright's disease is frequently œdema of the face. Œdema of the lower extremities indicates some difficulty in the return of blood to the centre of the circulating system, and is therefore most frequently met with in diseases of the liver, heart, or spleen, or in renal affections, or in cases where ascites or abdominal tumors disturb the circulation. In acute diseases with great debility, and in anæmia, partial œdema of the lower extremities and of the feet often occurs, without rendering the prognosis unfavorable, since it rapidly disappears upon the employment of appropriate treatment.

Coldness of the surface of the body often attends sinking of the general strength, and when extreme and attended with cold sweats, generally teaches that the fatal stage of disease is approaching; this is well seen in the state of collapse in cholera. Chilliness, shivering, horripilation, or rigors, with a remarkable feeling of coldness along the spine, usher in most of the febrile and inflammatory affections, just as increase of heat follows on the reaction of the vascular system. Shivering, when it occurs in intermittent fevers, is not a dangerous symptom; when it takes place during the course of inflammations, suppuration is to be dreaded. Rigors, also, at the height of such acute diseases as are associated with great depression, stupor, or cold sweats, are bad; they are much less unfavorable when followed by heat.

A harsh, dry, burning heat of the body is always unfavorable, but especially so in inflammatory affections of important viscera; if at the same time a sense of internal heat is experienced, with coldness of the feet and lower extremities, restlessness and anxiety, there is a great fear of a rapidly approaching fatal termination.

A perspirable condition of the skin is, in the majority of cases, a favorable symptom, and more so when it arises naturally than when due to medicine. On the supervention of the sweating stage in ague, remarkable relief is experienced, as occurs generally in most fevers, inflammations, and especially in rheumatic fever.

The Temperature of the Body.—The employment of the thermometer is one of the most valuable aids in the diagnosis, and frequently in indicating the correct treatment of disease. The revelations which it makes in all febrile affections are such as cannot be disregarded by any one who is in any way jealous of his reputation as a clinical observer or a good therapeutist. The student should learn at an early period of his career never to consider the "notes" of cases in which pyrexial disturbance may occur as complete without an accurate account of the temperature of the body, taken in severe cases night and morning, and even at other times. The reason of this will presently appear. Of course it has long been known that the heat of the body rises in "fever," but by the thermometer alone can we accurately measure its degree.

The thermometer for the student and practitioner should be a portable one. Originally the instrument was made of large size, and was carried in a cumbrous flat case. There are now, however, very handy little instruments. One of the best is Dr. Clifford Allbutt's clinical thermometer, made by Harvey and Reynolds, of Leeds; it is about six inches long, and fits closely into a round case, the thickness of a medium-sized test-tube. Dr. Allbutt tells us that Messrs. Harvey and Reynolds are making thermometers three inches in length, but, though very portable, they are scarcely so convenient as the others of larger size. These portable thermometers can be now obtained of any of the instrument makers, and cost about half a guinea. Full directions how to use the instruments are given with them.

The best place at which the temperature may be "taken" is the axilla. The instrument should be slightly warmed by the hand till it gets up to say 94° F. or so, and then placed in the axilla; after the mercury has remained stationary for three or four minutes the temperature may be read off. From ten to twenty-four minutes may be required for a correct observation.[1] In "noting down" the temperature a difference of a tenth of a degree may be disregarded. Several observations a day should be made in all cases of serious illness.

Before detailing the principal variations of temperature in disease, it is necessary to define the standand of health. From numerous observations this has been accurately determined. Dr. Ringer has recently stated the results of his experiments to the Royal Society as follows: that in persons under 25, the average maximum temperature is 99.1° F., in those over 40, 98.8° F. There is a diurnal variation, the highest point being maintained between 9 A.M. and 6 P.M. After the latter hour the temperature falls, and is lowest between 11 P.M and 3 A.M., reaching its highest point again at 9 A.M. The diurnal variation in persons under 25 amounts to 2.2° F. on an average; but it is very small (.87° F. perhaps) in those between 40 and 50 years of age. The normal temperature is *raised* by active exercise, by a rise in the heat of the atmosphere, by a residence therefore in warm climates (about 1° F.), and temporarily by hot baths. It is diminished by exposure to the cold without active exercise, by severe mental exertion, and temporarily by a full meal and cold bathing. The guide for the clinical observer to follow is thus stated by Aitken: *A rise about* 99.5° *F., or a depression below* 97.3° *F., is a sure sign of some kind of disease, if the change is persistent.* There are many affections which seem to be accompanied by true pyrexia, but the latter is found to be absent when the thermometer is used. A rise in temperature is on the other hand the sign most characteristic of fever. A very brief summary of what is at present known on this point will now be given, following the order taken by Aitken. In the febrile diseases, an increase to 100° or 101° F. only, signifies a mild attack. A constant temperature of 105° implies severity of disease, a rise to 106° or 107° denotes danger, and a fatal termination may be expected if the thermometer shows a rise to 109° or 110° F. But the observer should take the temperature of his patient carefully when the disease has fairly developed, so as to determine what is an average standard range by which to compare the future progress of the case.

These remarks apply with peculiar force to the case of typhoid fever, typhus, variola, scarlet fever, rheumatism, pyæmia, pneumonia, and the like.

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[1] See Bæumler, Brit. Med. Journ., Aug. 31, 1869.

In *typhoid* the temperature is the guide to the distinction between it and a host of maladies that may be confounded with it. At the beginning of the second week in typhoid a temperature of 102° F. or 103° F. in the evening may be found in a mild, 105° F. in a severe case. If the temperature falls at this time the case is not one of typhoid. When any special complication is likely to occur, such as hemorrhage, the temperature rises, and this is true of other diseases, such as tuberculosis. At the end of the third week or so, a fall (especially towards evening) in typhoid, is a sign of approaching convalescence, and it has a favorable significance even if the pulse keep high. A rise has a contrary significance. The term defervescence is used to signify the approach of convalescence, as evidenced by the fall in temperature. In the diagnosis of the diseases of children the thermometer is of the greatest use, and in many conditions which seem threatening, the thermometer will always indicate by a rise whether there is real mischief, and *vice versâ*. The temperature in children is, as compared with adults, somewhat more susceptible of rapid changes and accidental influences, hence the importance of repeated observation.

In *ague* a rise precedes by several hours the febrile paroxysm, and if the temperature continues at an elevated range, the disease still has its hold on the patient. In *pneumonia* a temperature of 101° is favorable, since no great or serious change can go on in the lung, especially of a suppurative kind, without a much greater elevation; 104° F. would indicate such an event. In *measles* much may be learnt in reference to the occurrence of secondary lung mischief after the rash has faded away. The thermometer is almost the only means which will indicate at an early stage the occurrence of lobular pneumonia. In *rheumatism* and rheumatic fever too, a rise to 104° would be followed most likely by pericarditis. So in the *puerperal* woman would the attack of puerperal fever or pelvic cellulitis be exposed. In *acute phthisis* a high temperature indicates active mischief or an increase of disease. If hemorrhage occurs in phthisis, and there be no rise in temperature, there is no "reactive pneumonia" set up around the hemorrhagic spots.

It can now be seen, therefore, that a careful observation of the temperature of any given case, from day to day, will often lend the most valuable aid in detecting the character of an attack of disease, and the likelihood of complications. It will also help materially in the formation of a prognosis, and a few words of general applicability may be added in reference to this latter point. We may sum up what is generally agreed upon by saying that whenever convalescence is about to be established, a regular fall of temperature will be noted, especially towards the evening. As, therefore, a gradual rise from morning to evening is bad, the reverse is equally favorable. A high evening temperature means an incomplete recovery, or the probable occurrence of some complication—such as suppuration, &c. On the other hand, as soon as the inflammatory tissue-changes in any disease come to an end, the temperature falls. Of course, it is implied that other symptoms do not get worse, or they improve; for if the temperature falls, and the pulse beats higher, and the symptoms generally assume a graver aspect, then the prognosis is bad: this state *may* mean that stimulants are required. Lastly, in convalescents, a rise in temperature indicates a probable relapse; and hence the importance of watching the temperature of those convalescents from severe febrile diseases who are not clearly making satisfactory progress.

A fall in the temperature of the body may be observed in remittent fever (the stage of remission); intermittents, acute collapse, chronic wasting diseases, and in pyrexia, when death is impending.

Pulse and Temperature.—Aitken lays it down as a rule that an increase of temperature of 1° Fahr. above 98° Fahr., corresponds with an increase of ten beats of the pulse per minute, as in the following table:

A temperature of	98°	corresponds to a pulse of	60
"	99°	"	70
"	100°	"	80
"	101°	"	90
"	102°	"	100
"	103°	"	110
"	104°	"	120
"	105°	"	130
"	106°	"	140

Respiration and Temperature.—In pneumonia the comparison of these two is useful. A temperature of

104° Fahr., a pulse of 120, and not more than 40 respirations to the minute, indicates a favorable prognosis.

Temperature and Excreta.—The valuable researches, especially of Dr. Parkes, and also Wunderlich, Virchow, and others, have established the fact that the degree of temperature bears a direct relation to the amount of waste products furnished by the body. These waste products appear as excreta, which are generally increased where the temperature is high : the excreta may however be diminished in fevers. This does not show that there is not a larger amount of loss of tissue or waste connected with the high temperature, but merely that it is not excreted—in fact, in all fevers in which the temperature is raised there is excessive tissue destruction or waste in the body—this is mostly shown by an increased amount of excreta, but the waste may in some cases be retained in the body, and then the excreta may be diminished, though the waste is equally great. Now it has been ascertained that when there is retention, critical discharges are apt to occur at the end of the case, or secondary complications to arise—an important clinical fact, that points to the necessity of making a careful examination of excreta when there is a rise in temperature. The amount of urea is the test of increased or diminished excretion. The normal amount is about 500 grains per day.[1]

SECTION II.

SYMPTOMS BELONGING TO THE ORGANS AND FUNCTIONS OF DIGESTION.

The symptoms and signs furnished by the digestive functions and organs comprise those evinced by the teeth and gums, by the saliva, by the tongue, by the taste, by deglutition, by the appetite, by jaundice, by nausea and vomiting, and by defecation.

The Teeth and Gums.—In persons of good constitution the *teeth* are often found sound and perfect until an advanced period of life ; their early decay indicates either prolonged disturbance of the function of digestion, or loss of constitutional strength, or constitutional vice, or the abuse of powerful medicines, as acids and mercurials. They become loose in scurvy, purpura, and in mercurial salivation ; while improper diet—especially the abuse of spirituous liquors, of acids, and perhaps of sugar, renders them carious at an early age. In low fevers they become covered with mucus and sordes of a dark brown color, the extent of the sordes increasing with the depression of the vital powers. The accumulation of tartar round the teeth is said to show a disposition to calculous and gouty affections. *Chattering* of the teeth occurs in the early stages of catarrh, fever, and acute inflammation generally: it is most marked in the cold stages of agues. *Grinding* of the teeth during sleep is common in irritable persons, and in children during dentition, or when suffering from intestinal worms, or from cerebral disease. *Notched* teeth are described by Hutchinson as characteristic of hereditary syphilis.

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[1] For fuller details the reader should consult Wunderlich's work, "Das Verhalten der Eigenwärme in Kränkheiten." Leipsic, 1868.

The *gums* are pale in anæmia, in most exhausting diseases, and after copious bloodletting. They are soft and disposed to bleed in scurvy, and in cancrum oris. They become red, spongy and swollen in purpura, diabetes, salivation, and in dyspepsia of long continuance. In lead poisoning they present a blue margin: a valuable symptom pointed out by the late Dr. Burton as pathognomonic of the contamination of the system by this metal.

The Saliva.—Increased secretion of saliva—salivation or ptyalismus—may occur from the use of certain medicines, as mercury, iodine, and antimony; from disease of the stomach, liver, or pancreas; and from any cause which can irritate the parotid, submaxillary, or sublingual glands, or the mucous membrane of the mouth, as dentition, aphthæ, small-pox pustules, glossitis, tonsillitis, &c. In epilepsy, hydrophobia, and occasionally in apoplexy, the saliva is also increased in quantity and frothy; while at the commencement of most acute disorders there is diminution, with thickening of it.

The Tongue.—The general indications afforded by the tongue are most important, since it not only sympathizes with the different parts of the alimentary canal and the organs connected with it, but more or less with the whole system.

The mode of protruding this organ deserves attention. When in acute febrile diseases its movements are not under the patient's control; when, upon being requested to put out the tongue, there is inability to do so; or when the organ trembles much in the attempt, there is either great prostration, or some exhausting nervous disorder, or dangerous cerebral disease. In the early stage of typhoid and typhus fever the tongue is tremulous. Under the same circumstances, a difficult, hesitating mode of speaking, resembling stammering, is very unfavorable. Slight paralysis of the muscles of the tongue, giving rise to indistinctness of speech, is not unfrequently the forerunner of general palsy. In chorea, the manner of suddenly protruding, and as rapidly withdrawing the tongue is very peculiar. In cases of facial paralysis, and especially in hemiplegia, when the ninth nerve is influenced by the paralyzing lesion, the tongue will be protruded towards one side, and towards the affected half of the body when fairly protruded ; this is owing to the muscles which protrude this organ being paralyzed on that side, and in full force on the opposite, so that the strong muscles prevail and push the tongue to the weakened part.

The *bulk* of the tongue may be increased or diminished. It may become enlarged from inflammation, or as a result of small-pox, scarlatina, syphilitic or cancerous deposits, or the action of mercury or poisons. Chronic hypertrophy sometimes takes place without any appreciable cause. When the enlargement of this organ is not sufficient to be very obvious, it may be frequently recognized by the appearance of indentations on the sides, caused by the pressure of the teeth : at the commencement of salivation such an appearance is common ; it may also be seen in debilitated and dyspeptic subjects, who have little tone in the system. Actual diminution in the size of the tongue is rare ; when it occurs it is probably due to a deficiency in the quantity of the blood, or to feebleness of the heart's action.

The condition of the tongue as to *dryness and moisture* is often significant. Those who sleep with the mouth wide open may have a dry tongue in the morning on waking, from the free evaporation. Dryness may exist in different degrees. It depends on a deficiency of saliva, or of mucus, and indicates a general tendency to diminished secretion : it is most common in continued fevers, in the exanthemata, in inflammation of the abdominal viscera and the serous membranes, and in many other diseases of an acute and febrile nature. When the tongue, after having been furred and loaded, becomes dry, rough, hard, and dark-colored, a state of great and most dangerous prostration is indicated, with contamination of the blood, and suppression of the secretions. Humidity or moisture of the tongue, is generally a favorable symptom, especially when it supervenes upon a dry or furred condition. In acute disorders the humidity first appears at the sides, and gradually extends: this change is usually accompanied with a diminution in the severity of the general symptoms.

The *color* of the tongue is often changed from the natural healthy hue. A pale color is frequently associated with a similar appearance of the gums and lips, and is seen in anæmia, after loss of blood, in affections of the spleen, and during the progress of chronic disorders. A very red tongue occurs for the most part in inflammations of the palate, tonsils, and pharynx, and in the course of the exanthemata; while in gastric and bilious fevers, and in severe dyspepsia, the redness is often limited to the tip and edges of the organ. When the blood is insufficiently aerated the tongue assumes a livid or purple color.

An *aphthous* state of the tongue is not uncommon in infancy, when it constitutes a special disease—the thrush—as well as in adults in the last stage of phthisis, and in several other severe visceral diseases when tending towards a fatal termination. Some forms of aphthæ are said to depend upon the copious development of microscopical parasitic plants—the *Leptothrix buccalis* and the *Oidium albicans.*

The *temperature* of the tongue is not often much affected. It is probably diminished in all diseases hastening to a fatal termination: in the collapse of epidemic cholera the coldness of the tongue is always well marked.

But of all the conditions of this member, the most valuable, as regards diagnosis, is that known as a *furred* tongue. In this state the tongue is covered with a morbid coating, varying in length, thickness, and color, and somewhat resembling the pile on the surface of cotton velvets. A furred condition of this organ is common in inflammations, in irritation of the mucous membranes, in diseases of the brain and its membranes, in all the varieties of fevers, and, in short, in almost all acute and dangerous maladies. The presence of a fur, however, is not always a sign of disease, since some persons habitually have a coated tongue, especially on rising in the morning.

When the fur is white, thick, moist, and uniform, it usually indicates an active state of fever, without inflammation of internal organs, and without any malignant tendency. When of a yellow hue, there is generally disordered action of the liver, with retention of bile in the blood. When brown or black, a low state of the vital powers is indicated, with contamination of the blood. In many instances the white fur of the tongue is modified by the tops of the red and swollen papillæ projecting through it, an appearance which is well seen in scarlet fever; as the fur clears away, these papillæ become more distinct, and give the tongue a strawberry appearance.

We may often learn much from the manner in which a furred tongue begins to clean. Thus it is a sign of a rapid and lasting convalescence when the fur slowly retires from the tip and edges, thinning gradually as it recedes. When it separates in flakes and patches, beginning at the middle or near the root of the organ, and leaving a smooth, red, glossy surface, the convalescence is apt to be more tedious and interrupted. Sometimes the fur recurs again and again before ultimately disappearing, especially in cases where the advance towards health is uncertain and unsteady. And lastly, when the crust is rapidly removed and the exposed surface left of a raw appearance, or glossy, or fissured, or dark colored, the prognosis is unfavorable. Cracks and small ulcers along the under side of the tongue are seen in syphilis, and in this disease, flattened white patches (psoriasis) may be seen over the surface of the tongue, often in connection with psoriasis palmaris.

The Taste.—The sense of taste is rarely rendered more acute than natural, though it is so occasionally in nervous affections, as hysteria, hypochondriasis, &c. It is often impaired in fevers, gastritis, gastro-enteritis, dyspepsia, catarrhs, and influenza: its early restoration in such cases is a favorable symptom. When lost from apoplexy, or some other cerebral disease, and when not restored during convalescence, a relapse is to be dreaded. A vitiated taste is common in disorders of the digestive organs, in affections of the lungs, in diseases of the uterus, and in all nervous complaints: it may be insipid, as in catarrhs; or bitter, as in diseases of the liver; or saltish, as in phthisis; or putrid, as in gangrene of the lungs; or metallic, as is occasioned by the action of metals on the system, such as mercury, iodide of potassium, &c.

Deglutition.—This may be difficult—dysphagia; or impossible—aphagia. Both conditions may arise from enlargement of the tonsils, pressure from abscess about the throat, diseases of the tissues with enlargement of the pharynx or of the œsophagus, or from disease of the brain, medulla oblongata, or their membranes, from structural changes in the nerves distributed to the tongue, pharynx, or upper part of the œsophagus, from spasmodic constriction of the œsophagus. When the result of functional nervous disorder, as in hysteria, it is generally accompanied with spasms in other parts, or with flatulent distension of the stomach, and a sensation as of a ball rising in the throat—globus hystericus; in such cases it is of little moment. The prognosis is more unfavorable when dysphagia occurs towards the termination of acute diseases, than when it does so at their commencement; when dependent upon paralysis or upon organic disease, it is also a very unfavorable symptom. Aphagia, unless caused by inflammation, is generally fatal.

The Appetite and Desire for Drink.—The appetite may be diminished, or increased, or depraved. The temporary loss of desire for food is one of the earliest results of disease, especially perhaps of fever, while its return is commonly one of the first evidences of convalescence. The perfect loss of appetite—anorexia—may depend upon the general disturbance caused by all acute diseases; or upon there being but little necessity for food, as in aged persons, and in those of weak constitution and sedentary habits; or upon malignant or chronic disease of the stomach or same other part of the alimentary canal; or upon functional derangement of the nervous system. Increased appetite—bulimia—more rare than the preceding, is occasioned either by an increased want of nutrition from excessive consumption of the living tissues or of the blood; or it may arise from irritation of the stomach, or from the irritation of worms in the intestines, or from disease of the nervous system. The existence of hunger during the progress of fever is generally considered a bad sign, as indicating great derangement of the nervous system. A voracious appetite with vomiting—the bulimia emetica of Cullen—is common in certain forms of inflammatory irritation of the pylorus or of the mucous membrane of the stomach, and in hooping-cough. A vitiated or depraved appetite—pseudorexia or dyspepsia pica—sometimes occurs in children, often in the insane, and in pregnant, hysterical, and chlorotic women. It is generally symptomatic of altered sensibility of the nerves;

or of a disordered condition of the gastric secretions dependent upon imperfect function; or of an irritated state of some organ related to the stomach, as the brain, uterus, ovaries, and large intestines.

The desire for drink is frequently morbidly excessive —polydipsia—and is often present when the appetite for food is completely lost. Thirst may arise from excitement or from depression; it accompanies most cases of inflammation and irritation, almost all diseases of the intestines, hemorrhages, and those disorders where the excretions are excessive—as diabetes, phthisis with profuse perspiration, simple and malignant cholera, &c. There is often the most pressing thirst for ice or cold water in fevers as well as in all malignant forms of disease attended with great prostration; for demulcent drinks in pulmonary affections; for vinegar or acidulous fluids in disorders of the uterine organs; and for alcoholic drinks in diseases of debility, and during the convalescence from fevers. In the majority of chronic maladies there is an absence of thirst.

Jaundice.—Icterus or jaundice, though often spoken of as a separate disease, is in fact only a symptom of disordered action of the liver. Dr. Murchison describes a "spurious jaundice," including the greenish-yellow color of chlorosis; the grayish-yellow waxen tint of skin in organic disease; the hue of those who have suffered from malarious disease or lead poisoning; the yellowness of conjunctiva due to subconjunctival fat; the "*icterus neonatorum*" of new-born children due to fading hue of the once congested skin; the bronzing of residents in hot climates, and the deception practised by malingerers by the use of turmeric, saffron, broom flowers, &c., the urine being heightened by taking rhubarb or santonine.[1] These spurious forms will be readily distinguished with a little care. True jaundice is due to the circulation of bile pigment in the blood. This jaundice has been supposed to be produced in two ways: 1st, by some impediment to the flow of bile into the duodenum, and the consequent absorption of the retained bile; and 2d, by defective secretion on the part of the liver, so that the principles of the bile are not separated from the blood. With regard to the first mode of causation no doubt exists. When the bile cannot escape into the intestines, the bile is absorbed into the system and jaundice results.

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[1] "Lectures on Diseases of the Liver." 1868

The most common impediment to the flow of bile into the duodenum is from mechanical obstruction in the bile duct—ex., the impaction of a *gallstone* in the ductus communis choledochus, or the presence of hydatids or foreign bodies in the intestines. Gallstones are made up of inspissated bile, and chiefly perhaps of cholesterine—a peculiar substance, which exists in a state of solution in healthy bile, but which under certain circumstances becomes released from its solvent, and assumes its natural crystalline form. In all cases the nucleus of the concretion consists of a small piece of solid biliary matter, or of inspissated bile cemented by mucus. When the obstructing stone or stones have passed into the duodenum they are voided with the fæces, and the cause of the jaundice being removed, the skin and conjunctivæ gradually assume their natural color, the fæces become dark instead of clay-colored, and the urine—from having been of a saffron hue—returns to its natural pale yellow tint. The other causes of jaundice from obstructed gall-ducts are, cancer of the liver or pancreas, closure of the ducts from adhesive inflammation of the liver, from spasm of the ducts, and from constipation—the loaded intestine pressing upon the duct, and so impeding the flow of bile. Murchison mentions also as causes of obstructed bile ducts acting from without, disease of the duodenum, stricture of the duct from ulcers and the like in the duodenum, closure by tumors, by pressure from without, as in cancer, enlarged glands, tumors of stomach, pancreas, kidney, omentum, aneurism, fecal accumulation, ovarian tumors, &c.

We now come to the second great group of cases, where there is no obstruction to the exit of bile from the bile-ducts. Dr. Murchison, in common with many other observers, is of opinion that all the essential elements of bile are formed in the liver and do not exist preformed in the blood, and the arguments which he has advanced in support of this view appear conclusive. If this be so, jaundice cannot result from what has been styled "*suppressed* secretion," to which it is the fashion to attribute the numerous cases where there is no obstruction of the bile-ducts. According to Dr. Murchison, the pathology of such cases of jaundice is in this way. In health, only a small portion of the bile secreted by the liver escapes with the fæces. The greater portion (including the pigment) is reabsorbed and plays an important part in the primary digestion. Jaundice does not under ordinary circumstances result from this reabsorption of bile, as this becomes transformed at once into urinary pigments and other substances, which are eliminated by the kidneys and lungs. But if anything interposes to interfere with this metamorphosis of bile in the blood, jaundice is the result. The conditions which *à priori* would appear best calculated to impede or arrest these metamorphoses would be poisons in the blood and nervous influences, and these are precisely the conditions under which jaundice independent of obstruction of the bile-ducts is known to occur.

The secretion of bile may be suppressed or rendered defective by congestion and inflammation of the liver; by mental shocks, or grief, or dissipation; by certain poisons in the blood; and by many disorders of the stomach.

The phenomena and symptoms proper to jaundice are the tinting of every part of the body by the bile pigment, even the fluids of the eye in severe cases. The liver is much stained, so is the skin, but in simple cases it is only slight, of course; the secretions are colored, especially the urine, which is "saffron-yellow, or greenish-brown, or brownish-black." The cutaneous excretions may be tinged. The taste is disordered, being bitter; there is deranged digestion in the shape of flatulence, constipation, and altered character of the motions, which are paler, and contain fatty matter undigested; the skin is itchy; cutaneous eruptions, such as boils, are apt to occur; the pulse is slower, unless there be pyrexia; there is a tendency to hemorrhage and general debility. In extreme cases white objects appear yellow. Cerebral symptoms, such as delirium, coma, stupor, &c., and a "typhoid" state, which Dr. Austin Flint believes is produced by the circulation of cholesterine (which he regards as the excrementitious product of nervous tissue), but which is due no doubt to the retention of excreta generally, are observed in severe cases.[1]

Nausea and Vomiting.—Nausea commonly precedes vomiting, and may be due to improper food, or to a disordered state of the digestive organs—especially the stomach, or to disease of the brain, or to some derangement of the nervous system. Vomiting is the ejection of food from the stomach, and the stomach is in relation with various other organs of the body, hence vomiting may be the result of disorder of the stomach itself, or of other organs and parts with which it has relations. In the first place the circulation of poisons through the system, animal or narcotic depressants, and the like, induce vomiting. Then overloading of the stomach, improper food, disease of the gastric or intestinal mucous membrane, cancer of the stomach, obstruction of the pylorus, obstruction of the intestines, peritonitis, nephritis, metritis, and most of the exanthematous fevers, are common causes of vomiting; when long continued, or when the vomited matters are fecal, the prognosis is very unfavorable. Nausea and vomiting, together with headache, and it may be constipation, especially in children, often indicate severe disease of the brain, such as tubercular meningitis, and must be regarded as dangerous symptoms; on the contrary, when observed in pregnancy, hysteria, or hypochondriasis, no alarm need be excited, since they are merely symptomatic of irritation transmitted by the ganglionic nervous system to the stomach. In vomiting due to some gastric or liver disturbance there is nausea, which is relieved by the vomiting, there is also disorder of the tongue, with pains indicating intestinal disorder, and headache follows the nausea or the vomiting. When vomiting is due to cerebral mischief, the vomiting is purposeless, the tongue is often clean, the vomiting is secondary to headache, there is constipation, and there is no retching. If considerable relief follow the vomiting, if loathing and nausea, oppression of the chest and stomach, and headache disappear, the prognosis becomes much more favorable. If, on the contrary, the phenomena which preceded the vomiting increase after it, and especially if eructations, hiccough, and spasms ensue, we must be prepared to find out that the disease has taken a dangerous turn.

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[1] See Murchison, loc. cit.

Again, the sooner the vomiting occurs after eating, the higher up in the alimentary canal is the disease seated. Thus when it takes place within one hour of taking food, the disease will be found in the stomach; when after the lapse of two or three hours, in the pylorus or duodenum; and after a longer interval, in the large intestines. Vomiting immediately after food occurs chiefly in ulcer of the stomach, or disease near the cardiac end of the viscus. *For the examination of the vomited matters, see the last Chapter in the work.*

Defecation.—The examination of the intestinal evacuations should but seldom be omitted in any case, and never in obstinate and severe diseases. A patient will often assert that the bowels are open daily, when the evacuation is very scanty, and quite insufficient to prevent a large fecal accumulation. Besides ascertaining the existence or non-existence of constipation, the practitioner should ascertain the color of the stools, their consistence, and nature.

The frequency of the evacuations will vary with the age and mode of living; children at the breast evacuate the bowels several times in a day; adults once; and old people, and those of sedentary habits, more rarely. Diarrhœa at the commencement of an acute inflammation of some organ not belonging to the chylopoietic system, is generally an unfavorable symptom, as well as when relaxation of the bowels sets in with collapse. If, however, the diarrhœa is followed by alleviation of the general symptoms, and if the strength increases, the prognosis is good. Tenesmus, or a constant desire to go to stool, with pain and inability to pass an evacuation, is a common symptom of dysentery, or of some irritation of the rectum—such as arises from worms, hemorrhoids, calculus of the bladder, retroflexion of the uterus, &c.

Constipation may arise from a general morbid state of the intestinal canal, such as is often produced by the habitual use of purgatives, or from the commencement of inflammation of some part of the intestines; from disease of the liver; from a want of contractile power in the coats of the rectum; from some mechanical obstruction preventing the progressive motion of the contents of the tube; or lastly, from organic or inflammatory disease of the brain or spinal cord, or their membranes.

Hæmatemesis or hemorrhage from the stomach, is an important occurrence, most common about forty-five years of age, and generally arises from organic disease of the stomach—ulcer or cancer. It also follows the congestion of the stomach consequent upon cirrhosis of the liver, or heart disease, and the application of irritants of all kinds, and it occurs in altered blood states, as in scurvy and purpura.

It is said to occur vicariously in amenorrhœa; this is altogether doubtful. The blood may be fluid or clotty; it is usually dark and grumous, being changed by the action of the gastric juice. The blood may really come in the first instance from the nose, throat, or œsophagus, or larynx, having been swallowed. We must therefore be careful to detect other signs of the existence of disease in the stomach, in cases of hæmatemesis.

SECTION III.

SYMPTOMS BELONGING TO THE FUNCTION OF RESPIRATION.

These symptoms are of great importance, not only in reference to diseases of the organs of respiration, but also in respect to many other maladies to which the human frame is liable; especially perhaps in regard to the diagnosis of diseases of the heart and large vessels, diseases of the brain, abdominal viscera, and certain febrile and constitutional disorders. I shall first make a few remarks upon the function of respiration, and then speak of the symptoms to be derived from dyspnœa, orthopnœa, the odor of the breath, the temperature of the expired air, cough, hiccough, expectoration, stertor, yawning and sighing, and lastly, sneezing.

The various and highly important physical signs of pulmonary disease made evident by auscultation, percussion, mensuration, palpation, &c., will be discussed in another part of this work, when treating of the diagnosis of the special diseases of the lungs.

The Respirations.—In judging of the signs derived from the character of the respirations, it must be remembered that this function is remarkably influenced or modified not only by disease, but also by age, sex, temperament, the sleeping and waking states, mental emotions, the position of the body, and the temperature and pressure of the air. Every respiration consists of an inspiration and an expiration, each occupying nearly equal spaces of time, the duration of inspiration slightly preponderating over that of expiration. In the healthy adult the act of respiration is performed almost automatically, about eighteen times in a minute, or once for every four beats of the heart; in women and children the respirations are quicker and louder, averaging in the latter about twenty-five in a minute. The number of respirations is also less during the sleeping than the waking state; in the recumbent position, than in the sitting; and in the sitting than in the erect posture. When, however, a part of the lungs is rendered unfit for performing its office, or when too great a quantity of blood is sent to the lungs for decarbonization, the frequency of the respirations becomes increased, this frequency varying until—in very unfavorable cases—it even reaches sixty in the minute. When, from any cause, a pause of three minutes takes place in the play of the lungs, death is said to result. In inspiration, the clavicles, first ribs and through them the sternum and all annexed ribs are raised; the upper ribs converge, the lower diverge; the upper cartilages form a right angle with the sternum, and the lower of opposite sides from the seventh downwards move further asunder, so as to widen the abdominal space. The reverse happens in expiration. During inspiration, whilst the ribs, &c., are moving upwards, the heart, lungs, and abdominal organs are descending, and of course the descent appears to be really greater than it is on account of the movement of the ribs. The respiratory movements in the child are specially abdominal, and in men the lower, and women the upper, part of the chest moves most. The movements of respiration may be, as Dr. Bennett puts it, altered (1) by general increase or decrease, as in asthma on the one hand, and obstructive disease in the larynx on the other; (2) by partial immobility, as in pleurisy, or by locally augmented expansion, as in the non-affected side in pleurisy; (3) by increased rapidity, as in pericarditis.

Dyspnœa.—This term literally signifies difficult breathing, a condition which arises when, from any cause—either derangement of function or change of structure—the proportion between the quantity of atmospheric air that reaches the lungs, and the quantity of blood that is sent to them from the right side of the heart to be arterialized, is altered. When the dyspnœa is permanent, the prognosis will be very unfavorable; the greater its degree also the more there is to fear, although it is not always directly proportioned to the organic change.

The conditions leading to this alteration are numerous and diversified. Thus the blood itself may be in such an unhealthy condition, as in malignant cholera, in anæmia or chlorosis, that its circulation becomes impeded; or it may become congested in the pulmonary capillaries, as in heart disease, and so retard the circulation, and, at the same time, hinder the entrance of air into the pulmonary cells; or it may be sent too quickly to the lungs, as in fever and inflammation. So also the fault may be in the air, which may be too much rarefied, or may have poisonous gases mingled with it, and be thus rendered unfit for aerating the blood. Different diseases of the lungs, giving rise to consolidation, or compression, or destruction of the pulmonary tissue, or loading of the bronchial tubes and air-cells with liquid, will shut out the air. Pneumonia, bronchitis, pulmonary hemorrhage, phthisis, pleuritic effusion, the presence of air in the pleura, pericarditis with effusion, and aneurismal or other tumors within or pressing upon the thorax, will operate in excluding the air from portions of the lungs; and consequently the respirations will be augmented, in order that the sound pulmonary tissue may counterbalance, by increased work, the loss of function in the diseased part. Constriction of the air-passages by spasm—as in asthma, or by the presence of tumors; obstruction of the trachea by false membranes—as in croup; or great swelling of the tonsils; or inflammation of the glottis, will all impede the entrance of air to the lungs, and give rise to dyspnœa. The pulmonary branches of the par vagum constitute the principal and constant *excitor*, as the nerves that supply the muscles of respiration—the phrenic, intercostal, spinal accessory, long thoracic, and the branches of the spinal nerves supplying the abdominal muscles—are the *motor* links of the nervous chain by which the automatic respiratory movements are governed. Hence disease in these nerves, or in the parts of the nervous system from which they arise, produces disorder in the function they govern, of the most serious kind. The ultimate branches of the par vagum being distributed over the stomach, accounts for the connection which so frequently exists between dyspnœa, dyspepsia, and functional derangement of the heart. And lastly, disease of the muscles of respiration themselves, gives rise to dyspnœa; the healthy muscles being stimulated to excessive action, in order to compensate for the loss of power in those affected.

Healthy inspiration is performed with ease and freedom, and is effected by a nearly equal elevation of the ribs,—a turning of their bodies outwards, by which the horizontal and antero-posterior diameters of the thoracic cavity are enlarged, and by a depression of the diaphragm; in women the respiration is more costal and less diaphragmatic than in men. Ordinary expiration is the natural return of the thoracic cavity to its size during rest, owing to the weight and elasticity of its walls; the diaphragm becomes relaxed, and ascends into the chest; the abdominal muscles, which had been protruded, return to their natural position; and the costal cartilages, which had been rendered tense by the act of inspiration, bring their elastic properties into play, and, aided by the resiliency of the lung, combine to produce a general diminution of the thoracic cavity. In certain forms of dyspnœa, the respiratory exertion is more perceptible in one part than in another, and authors therefore speak of abdominal, thoracic, and cervical respiration. In *abdominal* respiration the abdomen rises and falls considerably, the diaphragm being chiefly concerned, while the ribs remain motionless. It occurs when the thoracic movements are rendered painful by pleurisy, or fracture of the ribs; and also in apoplexy, and in cases of extreme prostration when an insufficient supply of blood is sent to the brain. The *thoracic* respiration, with suppression of the abdominal movements, indicates obstruction to the free action of the diaphragm, such as may arise from enlargement of the liver or spleen, from an over-distended stomach, ascites, ovarian dropsy, a very enlarged uterus, &c.; it also occurs in peritonitis, when each movement of the abdominal parietes increases the general distress and the local pain. And lastly, the *cervical* respiration — when each inspiration is effected with considerable exertion of the superior ribs, the sternomastoids, and other muscles of the neck—indicates that higher grade of difficult breathing so often seen in advanced stages of pulmonary or cardiac affections, and in obstructive disease of the larynx.

Orthopnœa.—Orthopnœa is said to exist when the derangement of the respiratory function is so great that the sufferer cannot lie down, but can only respire in the erect posture; in which position greater freedom is allowed for the expansion of the chest, and all pressure upon the diaphragm by the abdominal viscera is removed. This variety of dyspnœa is often witnessed in asthma, in certain stages of hydrothorax, in severe chest disease in children, in general dropsy, and in diseases of the abdominal viscera. In asthma, the paroxysms of difficult breathing are frequently so severe, that a person unacquainted with the nature of the disease would suppose the sufferer to be at the point of death; yet the attacks are seldom attended with immediate danger, and often rapidly pass away.

The Odor of the Breath is subject to great variation, being sweet and agreeable in perfect health ; foul and unpleasant in disorder of the digestive organs, where there are decayed teeth, and often in habitual drinkers, in salivation, in scurvy, malignant sore throat, &c. ; and generally peculiarly faint at the time of the flow of the catamenia. During the progress of the exanthematous, typhoid, and pestilential fevers, it is disagreeable and infectious ; but in no disease is it so bad—so overpoweringly offensive—as in gangrene of the lung, which may be almost diagnozed from the putrid odor of the breath alone.

The Temperature of the Expired Air.—In fevers, in sthenic inflammations of the bronchial tubes, lungs, or pleura, and in most inflammatory disorders during their early stages, the temperature of the expired air will be found raised more or less above the natural standard ; while, on the contrary, it is lowered in all malignant and depressing affections, as in the last stages of fever, in suffocative catarrh, and the collapse of cholera.

Cough.—A common symptom in diseases of the chest is cough, which may be defined as an abrupt, loud, and violent expiration, accompanied by a contraction of the glottis, trachea, and larger bronchial tubes ; it has for its object the expulsion of a foreign body, the presence of which is irritating to the air-passages. Cough may therefore often be regarded as conservative—as an effort of nature to expel something from the air-passages or lungs which should not be there. This is not always the case, however ; since if, in any way, any portion of the vagus nerve above the part where the pulmonary branches are given off be irritated, cough will result. When any matter is coughed up, it is said to be expectorated, the act is called expectoration, and the substances expectorated are called *sputa.*

There is a great diversity in the character of the cough, which has received names corresponding with its peculiarities. Thus we have the *dry cough*—that is, one which is unaccompanied by expectoration—an irritable cough, so to speak—so often resulting from exposure to cold, the inhalation of acrid or acid fumes and gases, the accidental passage of foreign substances into the trachea, the irritation of the glottis by an enlarged uvula, and so on. Many hysterical, weak, nervous women also suffer frequently from a *dry barking cough*—more painful to the bystanders than the individual who utters it—without any appreciable cause. A *dry hoarse cough* is often one of the earliest symptoms of severe affections of the larynx, trachea or lungs, which are afterwards accompanied by a moist cough ; of organic disease of the heart, or of the large thoracic bloodvessels, which implicate the vagus and its branches, or press on the air-passages ; and sometimes of an irritated condition of the mucous surface of the stomach and œsophagus, of inflammation of the liver, and of obstruction of the gall-duct ; in the latter case, however, the cough is generally *spasmodic*, recurring from time to time in severe paroxysms. In the onset of bronchitis, the cough is not only dry, but is described as *tight*. The *moist* or *humid cough*—that is to say, a cough accompanied by expectoration—may follow the preceding, or may occur primarily from any of the causes of common catarrh. In old people it is a frequent sign of chronic bronchitis ; and many delicate persons suffer yearly from *winter cough*, with excessive secretion of mucus, and relaxation of the vessels of the air-passages.

According as each paroxysm consists of one cough, or of a series of them, so a different condition is denoted. The occurrence of a single sharp cough is common in pleurisy, in which disease it is very painful, in the first stage of pneumonia, and in the early or crude stage of tubercular deposit. On the contrary, the cough recurs in paroxysms of some duration in croup, hooping-cough, asthma, bronchitis, emphysema of the lungs, phthisis with tubercular cavities, diseases of the heart, and in cerebral irritation. In many of these cases, moreover, the fits of coughing come on in unequal paroxysms ; severe exacerbations being especially frequent towards the morning, and less common as the evening approaches. In pertussis the cough is paroxysmal, spasmodic, consisting of a series of expiratory efforts, at the end of which a deep inspiration follows, accompanied by a "hooping" noise. The cough, too, makes the patient sick.

Hiccough.—Singultus, or hiccough, may be defined as an uneasy sensation at the præcordia, with a spasmodic, rapid, but momentary contraction of the diaphragm and other respiratory muscles, occurring at short intervals and causing a loud, frequent, and slightly painful inspiration. It is frequently produced in infants, young children, and aged people, by any slight irritation of the stomach or duodenum, by swallowing too hastily, and mental emotions, as laughter or crying ; uterine irritation also often gives rise to it in hysterical or pregnant women; inflammation of the liver, or diaphragm, or pancreas, or cardiac orifice of the stomach will cause it ; tumors pressing upon the eighth pair of nerves may originate it ; and lastly, it is common towards the fatal termination of many acute diseases, fevers, and hemorrhages, when it forms an important—because very unfavorable—symptom.

Expectoration.—Expectoration is the act of discharging by coughing, hawking, or otherwise, the secretions or fluids of the fauces and air-passages. The sputa are evacuated or expectorated with ease or difficulty, according to the nature and stage of the disease, the age and strength of the patient, and the viscidity or fluidity of the expectoration. An easy expectoration is usually regarded as favorable in all diseases of the respiratory organs. In children, the sputa are generally swallowed. The matter expectorated may really have come, of course, from mouth, nostril, or stomach, hence this source of error must be guarded against. The expectoration is *mucous* and free in catarrh and bronchitis, *purulent* in severe bronchitis and phthisis, *rusty* in pneumonia, *nummular* and *muco-purulent* in advanced phthisis, *suddenly and largely purulent* in the bursting of an abscess, *streaked with blood* in violent coughing, and *bloody* in obstructive heart disease, in the bursting of aneurisms, and in phthisis.

A difficult expectoration of viscid sputa, at the commencement of any pulmonary affection, is of no unfavorable import ; but it becomes so in an advanced stage of disease, whether the cause be want of secretion, or too little power to discharge it when formed. In gangrene of the lung, in the chronic bronchitis of aged people, and in phthisis as death approaches, the morbid secretion accumulates, is expectorated with greater difficulty, and the weakness increasing, the functions of the lungs become impeded, and ultimately arrested.

For the chemical examination of the sputa, and the signs to be derived from their general appearance, &c., see Chapter XIV, Section 2.

Hæmoptysis or Spitting of Blood.—In the majority of cases where blood, in fair quantity and bright, is coughed up, it is due to phthisis. There are few cases of the latter disease in which it does not occur, but blood may be "spat" in both small and even large quantities in many other diseases. It may come from many sources—*i.e.*, the nose, the mouth in cases of spongy gums, gumboils, and the like, from ulcers in the throat, and from congested throats in violent coughing; from diseased spots in the larynx—*i.e.*, in laryngitis and various forms of ulceration; from the bronchi, after violent coughing in chronic bronchitis, and in connection with disordered menstruation; from the air-passages at various parts, as the result of aneurisms that open into them from without; in heart disease with obstruction to the circulation—ex., mitral disease, hypertrophy and dilatation of the left ventricle; in disease of the large vessels in the chest, in mediastinal tumors, and lastly, from the lungs in pneumonia, cirrhosis, cancer, hydatids, and, as before observed, tubercle. Practically, when the amount of blood is marked, it arises from one of three conditions in the vast majority of cases: tubercular deposit, heart disease with lung congestion, or cancer of the lung. But cancer is not observed till about fifty, and after; heart disease with hæmoptysis till between thirty and forty; but phthisis at the earliest ages. Hæmoptysis, therefore, in a person under twenty-five or thirty, is generally indicative of phthisis. When the blood comes from parts other than the lung, or is the result of non-phthisical disease, there will be signs and symptoms indicative thereof of course. It is important to distinguish between hæmatemesis or vomiting of blood from the stomach, and hæmoptysis. Spitting of blood from the lungs is preceded by a saltish taste, a sense of weight at the chest (often at the top of the sternum), by slight pyrexia, sometimes dyspnœa, and a tickling cough, and the blood is brought up by the cough, and is of a bright red color and frothy. The stools are not dark; blood continues to be brought up with the cough and tinges the expectoration, and there are physical signs of organic disease in the lungs. In hæmatemesis, the blood is vomited up in large amount, but not continuously; it is dark, mixed perhaps with food. There are dark stools, because blood is passed through the intestines; there is epigastric uneasiness, no cough, and distinct abdominal disease may be detected. There are some cases in which hæmoptysis is not unfavorable, as in hooping-cough, where it may relieve congestion.

Stertor.—Stertor, or stertorous breathing, is merely that form of respiration in which each inspiration is attended with deep snoring. It occurs during the insensibility following an attack of apoplexy; in compression of the brain from fracture of the skull, and in many other cerebral diseases; and in cases of coma, a condition in which the functions of organic life—and especially the circulation—continue in full force, while the functions of animal life—with the exception of the mixed function of respiration—are suspended. It is one of the symptoms that make up the state called *coma.*

Yawning and Sighing.—These are nearly related phenomena, consisting of prolonged and deep inspirations, with short and strong expirations; and indicating fatigue from nervous exhaustion and weariness, or the depression arising from ungratified mental desires. Yawning is generally a sign of mental vacuity and fatigue; sighing, of mental depression and sorrow. Yawning is often a troublesome and, generally, an unfavorable symptom after an attack of hemiplegia; it comes on when the first effects of the shock are subsiding, and is troublesome in proportion to the severity of the shock.

Sneezing.—Sneezing—sternutatio—is produced by a deep inspiration, followed by a violent, loud, convulsive expiration, whereby the air is driven rapidly through the nasal fossæ, carrying with it the mucus and foreign bodies adhering to the Schneiderian membrane. Anything which stimulates the nasal mucous membrane will cause sneezing. It is ordinarily occasioned by common catarrh, or by disease of the respiratory organs; it is sometimes a sympathetic phenomenon in hysteria, and in irritation of the intestinal canal from worms, &c. Accompanied by vertigo and tinnitus aurium, it sometimes precedes or ushers in a fit of apoplexy, or an attack of paralysis.

SECTION IV.

SYMPTOMS BELONGING TO THE FUNCTION OF CIRCULATION.

The morbid affections of the function of the circulation are observed chiefly in palpitations of the heart and large vessels, in the pulse, in the condition of the capillaries, in certain symptoms derived from the venous system, and in the state of the blood.

Palpitations of the Heart and Large Vessels.—In a state of health we are not generally sensible of the beating of our hearts; but when the pulsations become much increased in force or frequency, the distressing sensation known as palpitation is experienced. Increased action of the heart results from many conditions, without and with organic disease of its structure, both from slight causes, such as violent exertion and mental excitement, as well as from severe ones, especially such as give rise in any way to obstruction of the circulation. In enlargement of the heart with thickening of its parietes, or inflammation of the heart, there is palpitation, and the pulsations of the carotids and other large arteries are violent, and painfully felt. So, in atrophy of the heart with thinning of its walls, this organ beats more freely than in hypertrophy, but the pulsations spread over a greater extent of surface: the beating of the large vessels is not felt. There is also more or less palpitation when the circulation becomes deranged from disease of the lungs; as in pneumonia during the stage of hepatization, in severe bronchitis, in hydrothorax, pleurisy, pneumothorax, asthma, laryngitis, &c.

Palpitation is a common symptom in hysteria and other nervous disorders; and a more common symptom still, is a feeling of "fluttering" at the heart, and in the region of the stomach, with throbbing of the temporal arteries. A sensation of pulsation in the epigastric region is often connected with imperfect digestion in irritable constitutions, and gives rise to great distress; it follows the inordinate use of tobacco, want of sleep, flatulence, dissipation, free natural discharges, sexual excess, anæmia, spinal irritation, and occurs in the early stage of phthisis, chlorosis, &c. A similar pulsation is experienced in aneurism of the aorta, or when any tumor lies over this vessel. But the most extraordinary degree of palpitation and of morbid pulsation in the large arteries is observed in instances of exhaustion from the loss of blood. In one case of flooding after parturition, the patient complained much of her sufferings in this respect, and stated that she could feel every artery in her body beat, until her condition was relieved by the free employment of stimuli.

The Pulse.—In examining the pulse, there are a few brief practical rules which it behooves the physician to bear in mind. Thus—

1. The pulse should be felt by applying three or four fingers to the radial artery, as it lies in front of the wrist. After ascertaining the frequency and equality of the

pulse, the fingers should alternately press upon the artery, and relax the pressure, so as to appreciate the degree of resistance. The pressure should be sufficient to allow of the beats of the artery being distinctly felt, yet not so forcible as to obliterate the pulse, however weak it may be. The artery at the wrist affords, in the majority of cases, the most eligible part for ascertaining the state of the pulse; still it occasionally becomes necessary to examine the artery near the seat of disease, as, for example, the temporal artery in cerebral affections.

2. In feeling the pulse of timid, nervous, or excitable persons, great calmness and caution is necessary, in order not to excite the heart to increased frequency of action. The patient should be engaged in conversation, so as to divert his attention, and the practitioner should wait until the first agitation occasioned by his visit has subsided. The indications afforded by the pulse cannot be relied upon immediately after bodily exercise, or mental emotion of any kind.

3. The patient should be in the sitting or horizontal position, unless it be desirable to ascertain especially the effect of standing. Both wrists should be examincd, since the vessel on one side is sometimes larger than that on the other; moreover, the artery sometimes deviates from its natural course, so that the patient may *appear* pulseless. Care must be taken that no pressure is exerted upon the artery in any part of its course by ligatures, tight sleeves, tumors, &c.

4. The pulse should, in acute cases, be felt more than once at each visit; its diversities will be thus positively ascertained, and the conclusions formed by the practitioner from the first examination will be confirmed or corrected.

The pulse is produced by the blood sent into the aorta by each systole or contraction of the left ventricle of the heart; consequently, its nature will depend on the condition of the arteries, of the blood, and of the heart. In each pulsation the artery is slightly expanded, and perhaps laterally displaced; it then returns to its original size and position, after which there is an interval of rest. The frequency of the pulsations, and the regularity or irregularity of their succession, must depend upon the heart. The pulse at the wrist corresponds to the systole of the ventricles, making allowance for the slight interval that must elapse before the wave of blood reaches so distant a part.

In the healthy adult male, the pulse may be described as regular, equal, compressible, moderately full, and swelling slowly under the finger ; in the healthy female, and in children of both sexes, it is rather smaller and quicker in the beat. In individuals of a sanguine temperament, the pulse may be described generally as full, hard, and quick ; in those of a nervous temperament, it is softer and slower. In old age, the pulse assumes a hardness which it would not otherwise possess, owing to the increased firmness of the arteries.

The pulse has its maximum *frequency* in early infancy, and its minimum in robust old age. According to Quetelet, it may be estimated to range in infancy from a maximum of 165 to a minimum of 104, the mean being 135. This agrees with the conclusions of most authorities in this country, who regard it as being—at this period of life—on the average 140.

Dr. Guy, as the result of his observations, affirms that the pulse may be stated, in round numbers, as being

At birth,	140
During infancy,	120 to 130
In childhood,	100
Youth,	90
Adult male,	70—75
Adult female,	75—80
Old age,	70
Decrepitude,	75—80

The standard pulse of an adult male being about 70 ; of an adult female 80.

There are many instances of individual peculiarities—men and women with very slow and very rapid pulses.

The pulse is modified by several circumstances besides disease. Thus *posture* has a very considerable influence on its rhythm or frequency, even in healthy persons ; this influence being still more marked in disease, more in males than in females, and in adult age than in youth. The pulse is more frequent standing than sitting, and sitting than lying ; on the contrary, it is stronger lying than standing, so that its minimum of frequency and its maximum of strength are attained together. According to Dr. Guy,[1] the mean numbers of the pulse, in the healthy adult male, are as follows : Standing, 79 ; sitting, 70 ; lying, 67 ; while, in the healthy adult female, the numbers run: Standing, 89; sitting, 82; lying, 80. Dr. Graves laid it down as an established law, that in a debilitated person, when a sudden change of position—as from the erect to the horizontal—makes little or no difference in the frequency of the pulse, we may conclude that the heart, or at least its left ventricle, is increased in size and strength.[1]

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[1] Hooper's "Vade Mecum."

Sex influences the frequency of the pulse to some degree. The female pulse differs but slightly from that of the male during the earlier years of life; but after about eight years of age, the mean pulse of the female exceeds that of the male by from six to fourteen beats, the average excess being about nine beats in a minute. The pulse is usually also more frequent and more developed during pregnancy, especially in excitable women.

Muscular exertion temporarily increases the frequency of the pulse more than any other cause. This is especially the case in the early part of the day; the pulse, moreover, being always more frequent and more excitable in the morning than in the evening; the diminished frequency of the pulse towards the after-part of the day probably depends on the exhaustion of the strength. The pulse falls during sleep, considerably in children and in irritable nervous persons, but slightly in healthy adults. The general effect of food is to excite the pulse; warm drinks, alcoholic liquors, and tobacco especially do so. So also heat, inflammatory action, fever, extreme debility, sleeplessness, the first stage of plethora, loss of blood, and the exciting passions and emotions increase the frequency of the pulse, from seventy or eighty beats in a minute, up to 100, 120, or even to 200; while cold, continued rest, sleep, slight fatigue, want of food, digitalis, increased atmospheric pressure, and the depressing passions of the mind, diminish its frequency to 60, 55, or even 40 beats per minute.

Quickness of pulse differs from frequency, the latter having reference to the successions of the pulsations, the former to each beat separately. A frequent pulse is one in which the number of pulsations is greater than usual in a given time; a quick pulse, one in which each beat occupies a less period of time than naturally, although the whole number of beats may not be materially increased. A quick pulse is generally a sign of nervous disorder, indicating irritation with debility; a frequent pulse is indicative of arterial excitement—frequently of inflammation, or of great depression, as just shown.

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[1] "Lectures on Clinical Medicine." Second edition, vol. i, p. 50.

The *jerking* pulse is characterized by a quick, rather forcible beat, followed by a sudden, abrupt cessation, as if the direction of the current had suddenly changed: it was pointed out by Dr. Hope as indicative of deficiency of the aortic valves, and consequent regurgitation into the ventricle. Somewhat allied to this is the *thrilling* pulse of aneurism, cardiac disease, or anæmia.

Regularity of the pulse is generally a favorable sign in disease, although cases are recorded in which the pulse being uniformly irregular, or even distinctly intermittent in health, has become regular during the progress of disease, and resumed its irregularity on recovery. The *intermittent* pulse—that in which a pulsation is occasionally omitted—is often due to some obstruction to the circulation in the heart or lungs, to aortic aneurism, or to some cerebral disturbance, particularly inflammation and softening of the brain, apoplexy, &c.; slighter causes, however, occasionally produce it, especially perhaps dyspepsia with flatulence, when occurring in the debilitated or aged. The *irregular* pulse is a higher degree of the intermitting, the pulsations being unequal, and continuing an indefinite time; disturbances of the circulation, of the respiration, or of the functions of the brain, give rise to it; it is not unfrequently met with during the puerperal state, especially at the accession of puerperal fever.

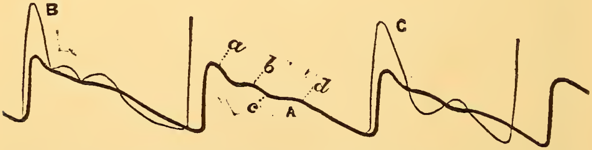
The *volume* of the pulse may be greater than usual, when it is said to be *full*, as in general plethora, and in the early stages of acute diseases; or less than usual, when it is known as *small* or *contracted*—being sometimes so small that it is said to be *thread-like*—as in anæmia, after severe hemorrhage, and in all cases of great prostration. When the pulse resists compression it is termed *hard*, *firm*, or *resistent;* when very hard and at the same time small, *wiry; softness* of the pulse is almost synonymous with compressibility, and generally indicates defective tone and loss of vital power.

In fever, a dicrotous pulse—that is to say, a pulse in which two beats occur rapidly to be succeeded by a pause—which is at the same time hard, is a very unfavorable symptom, especially if it continue more than twenty-four hours; if, however, it is succeeded by epistaxis, and then disappears, it is more favorable. When, in fever, a hard dicrotous pulse lasts for many days, without any tendency to hemorrhage, the case—in nine out of ten—ends fatally. In hæmoptysis, long-continued epistaxis, and internal inflammations, a very hard dicrotous pulse sometimes occurs, which resists all treatment, and portends a fatal issue. The term dicrotous is, however, now generally used in another sense from the above—viz., to denote a certain pulse-curve obtained by the sphygmograph. (See p. 161.)

Lastly, if the pulse at both wrists be not isochronous or equal—if the beats do not occur at the same time—we must suspect disease of one or the other radial arteries, or that pressure is made upon some part of the arterial tract, between the heart and wrist by a tumor, aneurism, &c.

The Sphygmographic Study of the Pulse.[1]—The sphygmograph is an instrument by the use of which the pulsations of the radial artery are represented in diagram. A sensitive lever armed with a point at right angles to the shaft is made to move up and down by placing one end of it over the radial pulse, the point is then made to come in contact with a piece of smoked glass or paper which moves along in front of it. A curved line is therefore written by the moving point upon the moving glass or paper. The pulse is written off as it is called. Pulse writing is another term for sphygmography. This graphic study of the pulse is most important to the physician, and much has been done to give it a scientific basis by the labors of Marey, Anstie, Sanderson, Foster, and a few others. We have to consider in regard to the force which moves the index of the sphygmograph, the action of the heart which expands the arteries, the degree of resistance offered by the arteries, the effect of the onward wave of blood in the arteries, and the controlling influence of the nerves over the vessels. As these vary

FIG. 1.



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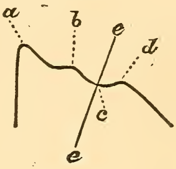
[1] See Anstie, *Lancet*, July 13, 1867, et seq.

so the pulse tracing varies. Now when the sphygmograph is used to the radial artery of a healthy subject, we have a pulse curve, or tracing similar to that which is shown at A, Fig. 1. The curves represented at B and C will be referred to presently; they are only placed where they are for the purpose of being compared with the healthy pulse curve.[1]

It will be noticed that there is one primary (*a*), and two secondary curves (*b* and *d*), the latter, in vigorous health, being very slightly marked indeed.

The first or main elevation (*a*) corresponds to the systole of the heart; it is called "the percussion impulse;" the first secondary elevation (*b*) represents the effect of the wave of blood onward through the arteries after the systole, the "systolic pressure wave" as it is called; the line from *b* to *c* which follows indicates the closure of the aortic valves. This is followed by the second elevation. These points may be represented in diagram as in Fig. 2: *a* is the systolic percussion impulse, *b* the first secondary elevation or the systolic pressure wave; *c* indicates the lowest point of pressure in consequence of the closure of the aortic valves, and is sometimes called the "aortic notch," whilst the line *e* divides the systolic from the diastolic phenomena.

FIG 2.



There are certain physiological variations in the pulse compatible with health, and here we follow Dr. Anstie. The line of ascent to the large elevation is not quite vertical; but it slants upward if the arterial tension is good. If the tension is low the large elevation or the percussion apex may be slightly double or treble. During full digestion, where there is languor, the pulse is what is called

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[1] Messrs. Mayer and Meltzer have constructed a very handy sphygmograph, which is very portable, instantaneously adjusted, and extremely susceptible to the slightest variation of the pulse. With Marey's instrument the adjusting takes considerable time, and in some cases a successful result is hard to obtain; but this instrument never fails. It is instantaneously applied across the wrist by the approximation of two concave projections below, and the pressure on the artery is easily modified by a sliding adjustment. The complete apparatus, including half a dozen glasses, is contained in a box 5½ by 3½ inches; the box also forms the rest for the arm.

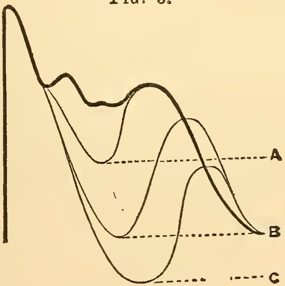
dicrotous. The first elevation is high; there is no second wave visible, and the rise after the aortic notch is very prominent. This is seen at C, Fig. 1. The pulse tracing at B, Fig. 1, is that of fatigue; the first elevation is high; but the first secondary elevation is not wiped out as in the dicrotous pulse. Now a dicrotous pulse may be produced in a healthy person by an excessive dose of alcohol, by external heat of marked degree, or by severe emotion. It is also the pulse of pyrexia. It follows, therefore, that sphygmographic observations must not be made within two hours of a solid meal, during fatigue, nor immediately after violent exercise or emotion, or the action of marked external heat upon the body. So far, then, for the "physiological" changes in the pulse coincident with health, and their significance in reference to diagnosis.

Now we proceed to speak of changes indicative of disease, and first of those which affect the line of ascent in the pulse-curve. If the heart be powerfully acting there will be a greater tendency to length of line of course, but this will be limited by the degree of tension in the arteries—that is, if the heart action be good and the tension good, the line of ascent will be of moderate height, but the line of descent will be faintly marked with the usual elevations. If the heart be weak, and the tension low, then there will be a short line of ascent—a blunt or rounded apex, and the dicrotous wave nearly as large as the first. This is readily understood.

If the line of ascent (to the primary elevation) be vertical, it means that the heart is acting rapidly, and it is short in proportion as the heart is weak. The line of descent is long in health with good arterial tension, inasmuch as the pulse wave is slow, which means slowness of the heart's contractions. There is one more matter that needs to be mentioned in connection with the line of ascent, and that is the character of the apex of the primary elevation. In health, when the ventricular systole ends, the blood flows on into the capillaries, and the arterial distension lessens. The force of the heart and the tension of the arteries are balanced, so to speak, as shown by the acute angle formed at the point of junction of the lines of ascent and descent. But suppose the arterial expansion or distension be insufficient, as in senile degeneration of the arteries, then we have the line of descent delayed in its commencement, and a square apex is produced. This is seen in hypertrophy of the heart as well as in senile degeneration of the arterial system. It follows then that inasmuch as a healthy pulse tracing should be of moderate height, with a nearly vertical ascent, an acute apex, a gradual descent, and two secondary waves, an abnormal pulse may be shown by alteration of these several points, and we must briefly state the diseases in which they severally occur, and their significance.

In Fevers the pulse is, as we have before said, *dicrotous*—that is, the aortic notch deepens, and the first secondary curve disappears. There is an ascent and then a descent with one secondary elevation, or one curve in the descending line. The amount of dicrotism is in direct ratio to the degree of pyrexia. If the pyrexia be mild the pulse-tracing is sub-dicrotous. When the fall subsequent to the elevation is extreme, it is called hyper-dicrotous, and this is a grave sign. The varieties of fever-pulse are thus represented by Dr. Anstie, diagrammatically of course.

FIG. 3.



A is mildly dicrotous, or sub-dicrotous.
B is "full" dicrotism, the aortic notch reaches down to the level of the pulse-curve basis.
C is hyper-dicrotism, the aortic notch reaches below the level of the pulse-curve basis.

There are certain other characters of tracings observed in febrile states which are of grave import, and may aid in forming a prognosis. They are as follows :

(*a*) A pulse with a small curve, a primary ascent which is not vertical, and a blunt or much-rounded or square apex. This indicates a long and labored weak systole.

(*b*) Inequality and difference of form of the curves indicates a varying power of the heart's contraction.

(*c*) Irregular waves in the general line of the pulse-tracing are bad. The respiratory movements may influence the curves, but then there are successive batches of irregularities of the same kind. We now refer to absolute irregularity, which indicates, as Dr. Anstie puts it, that the heart varies in its contractions from moment to moment.

(*d*) A hyper-dicrotic pulse-wave, assuming the character last mentioned, in which the curves are small, is bad in the advanced stage of fever.

(*e*) A hyper-dicrotic pulse is bad if it still hold on in typhoid at the time at which convalescence should occur (24th—25th day), and do not become sub-dicrotous.

It should be mentioned that a *large* simple curve at an early stage of disease is not of bad augury, the truth being "that the spring cannot follow the rapid oscillations of the blood column."

Aortic Obstruction is indicated by a difficult and a much sloping ascent and a round apex, with absence or slight marking of the secondary curves. The size of the pulse will depend on the presence or absence of hypertrophy.

In Aortic Regurgitation.—If it be known that there is regurgitation, a high degree of the incompetence is evidenced by an absolute want of the third wave.

In Hypertrophy of the Heart the apex of the first elevation is more or less square, the other features remaining like to those of the healthy pulse.

In Senility of the Arteries where there is no hypertrophy, but we want to know whether the arteries are diseased, we may conclude they are if the pulse-wave is of moderate height, the apex square, and there be no dicrotic wave.

Aneurisms.—Any aneurism situated so near the wrist as the *subclavian* or *axillary* will show itself, whatever be the external appearance, by a curve which is unmistakable. The apex formation is wiped out, and we get a mere arc of a circle or perhaps almost none at all, whilst the tracing on the other side is altogether different. In aneurism of the innominate artery there will be a difference in the pulse-tracings of the two sides. If the aneurism be sacculated there will be a diminution of strength in the pulse of the affected side, as shown by a curve smaller and of less height and squarer than on the other side. If the aneurism be fusiform there will be a larger pulse-wave on the innominate than on the other side. In aortic aneurism all depends on the part of the aorta affected. If it be the portion immediately above the valves, and the disease engage the aorta alone, no difference will be observed in the pulse-tracings. The same is the case when the centre of the arch is affected. Supposing the aneurism to involve the innominate, it may make the pulse-tracing assume an oscillatory character, and if it fairly engage the orifice of the innominate the pulse will be weakened. Nothing can be learnt with reference to an aneurism near the carotid. If the orifice of the left subclavian be involved a jar may be produced, and if there be a true subclavian aneurism, the apex of the pulse-curve goes, as before stated.

Lastly, the sphygmograph is of use in indicating the therapeutics of disease. If we give alcohol with benefit, the dicrotism in fever should diminish, the aortic notch be shallowed, the dicrotic wave occur sooner after the primary part of the curve—*i. e.*, the percussion impulse wave produced by the ventricular systole.

Condition of the Capillaries.—The state of the capillary circulation on various parts of the surface, often furnishes indications of some importance as respects vascular action and vital power, especially in the exanthematous fevers and in cachectic diseases. By pressing the finger upon the skin and noticing the rapidity with which the blood returns into the whitened spot, we ascertain the rapidity of the circulation through the capillaries: when the blood returns quickly into these minute vessels, the circulation is active and healthy; when it returns immediately, and the skin is of a vivid color, there is congestion; while if the redness at any one part remains unaffected by pressure, we may be sure that there is extravasation of blood. As old age advances the capillaries become impaired in vital tone, and the skin consequently is rendered colder and paler than in adult life. The same occurs frequently from exhausting diseases, denoting a failure in the general strength of the system, which demands our greatest attention.

Venous Symptoms.—The veins furnish signs of disease by their dilatation and over-distension, as occurs in the veins of the temples, face, and neck, in congestion of the brain; by the slowness or rapidity of their distension when pressure is applied in their course to the heart, showing the excess or deficiency of blood in the system; and by their occasional pulsations. The occurrence of a venous pulse results either from a continuation of the heart's impulse through the capillaries, when the circulation is much excited; or from an artery lying under or near a vein; or it may be due—when felt in the jugulars—to a retrograde current, produced by inordinate contraction of the right ventricle and regurgitation of blood, owing to hypertrophy of the right ventricle with dilatation of the right auriculo-ventricular orifice and imperfect closure of the tricuspid valve.

State of the Blood.—In man, as well as in the most perfect animals, the blood during life never rests, but is constantly in active motion, running in a double circle, from the first respiration until death. Having become impure in the course of its circulation, it is purified in the lungs; the pure blood is then sent all over the body, when a part of it becomes solid, a part is removed by the secreting organs, and the rest becoming venous is again returned to the lungs and heart.

The supply of blood being adapted to the capacity of the vascular system, any deviation from the normal quantity will affect the whole body. *Excessive fulness of blood* will give rise in proportion to the fulness to a full, broad, and tense pulse; to congestion of the sinuses and other vessels of the cerebro-spinal system; to congestion of the lungs, liver, and other important viscera, as well as to spontaneous hemorrhages. *When the blood is deficient in quantity*, the pulse will be found soft, weak, and very compressible, the impulse of each wave of fluid through the artery being quick and sudden; the vital powers will be found depressed to a low state, the organic nervous energy weakened, and the different functions will be feebly, if not imperfectly performed.

The morbid effects of the loss of blood may be divided into the *immediate* and the *remote*. The *immediate* effects are syncope or fainting, from its slightest to its fatal form; convulsions, most apt to occur in children, and in cases of slow and excessive draining of blood; delirium, as is frequently seen in flooding after parturition; coma, the comatose condition being often as perfect as after a fit of apoplexy; and lastly, sudden dissolution may take place from copious bloodletting. The *remote* effects are exhaustion with excessive reaction; exhaustion with defective reaction ; exhaustion with sinking of all the vital powers ; mania ; and coma, from which it is impossible to recover the patient.

Happily, owing to our increased knowledge of disease, the use of the microscope, and the aid of chemistry, we are able, in the present day, to ascertain all that it is desirable to know of the nature of the blood from the examination of a very small quantity.

If the quantity of blood in the system influences disease, it will readily be imagined that the *quality* of this fluid must do so to a very important extent; and such is the case. There is, however, no absolute standard analysis of the blood to which all other analyses may be positively referred, since each moment the composition of this fluid, as a whole, is changing. Thus, the water is always varying in amount ; the nitrogenized and unnitrogenized substances are always changing in quantity ; even the salts, even the alkalescence of the blood, is in a perpetual state of variation, being hardly the same at any two moments of the day. If this is the case in health, how much more so will it be the case in disease. The following may be regarded as the analysis of healthy human blood :

Water, ...	784.	parts	per 1000.
Red corpuscle (solid residue), .	131.	"	"
Albumen of serum, . . .	70.	"	"
Saline, ...	6.03	"	"
Extractives, fatty matter, . .	7.77	"	"
Fibrin, ...	2.2	"	"

Arterial blood differs from venous in color, and this is accounted for by the existence of two forms of cruorine, the one purple, the other scarlet. It also differs in composition : arterial contains more fibrin and rather less albumen and fat, more oxygen and less carbonic acid, and coagulates more rapidly than venous.

The facts which have been satisfactorily made out concerning the morbid conditions of the human blood are not very numerous, and much remains to be accomplished. Amongst the chief diseases, however, in which a pathognomonic condition of this fluid has been discovered may be mentioned inflammatory affections, characterized by the constant increase in the amount of the fibrin. This is the case in rheumatism *par excellence*, also in pneumonia, phthisis, serous inflammation. In fevers of a low type, the fibrin is diminished, also in hemorrhage, scurvy, and inflammation of the mucous surfaces; in plethora, the red corpuscles are increased; in anæmia there is a decrease in the red corpuscles; certain renal affections are characterized by diminution of the solids of the serum, and frequently by an accumulation of urea; typhoid fever, by a diminution of the salts; gout, by the existence of uric acid, as has been so ably demonstrated by Dr. Garrod; diabetes, by the presence of sugar; jaundice, by the existence of the coloring principle of the bile; in insanity—more than two-thirds of the cases of madness are the result of some alteration in the blood—(Romberg); and in cholera, there is a marked diminution of the water—causing the blood to become thicker, tar-like, and less coagulable, the red corpuscles to be relatively in excess, with increase in the solid portions of the serum—especially the albumen, and a retention of urea. Albumen is increased in rheumatism, pneumonia, and pleurisy, and diminished in Bright's disease, typhus, scurvy, dysentery, and puerperal fever.

A few years since Dr. Garrod discovered a substance in the blood which crystallizes in microscopic, octahedral crystals, and which he regards as oxalate of lime. And, more recently, a very curious disease has been described by Virchow and Dr. Hughes Bennett, named by the latter leucocythemia, from *λευκὸς*, white, *κύτος*, a cell, and *αἷμα*, the blood; literally, white-cell blood. On examining the blood microscopically, under a magnifying power of 250 diameters, in a case of leucocythemia, the yellow and colorless corpuscles are at first seen rolling together, the excess in the number of the latter being at once recognizable, and becoming more evident as the colored bodies become aggregated together in rolls, leaving clear spaces between them filled with the colorless globules. A drop of blood taken from a prick in the finger is sufficient for examination. The white corpuscles should be in the proportion at least of one to twenty to constitute this disease. The chief symptoms presented by a person suffering from leucocythemia are great pallor, with gradually increasing emaciation and debility, hemorrhage, diarrhœa, dyspnœa. This disease is found to be associated with enlargement of some or all of the following glands—the liver, spleen, thyroid, thymus, supra-renal capsules, and lymphatics. Virchow believes that the ductless glands, including Peyer's patches and the tonsils, are organs manufacturing the pale blood corpuscles, and that leucocythemia is due to an excessive action on their part. However, enlargement of these glands may occur without leucocythemia, though the reverse is not observed. Trousseau gives the average duration of the disease as from thirteen to fourteen months. After death, masses of white-blood cells have been found in the clots of the heart and in the veins. Some further comments relative to the presence of sugar in the bloodvessels will be found in the section on Diabetes. The accumulation of urea in the blood in certain cases of inflammation of the kidney gives rise to uræmia.

For an account of the chemical and microscopical examination of the blood, see Chapter XIV, Section 1.

SECTION V.

SYMPTOMS CONNECTED WITH THE URINARY AND SEXUAL ORGANS.

The *symptoms furnished by the urinary organs* divide themselves into two classes—*i. e.*, into those to be gathered from a chemical and microscopical examination of the urine, for the purpose of discovering those morbid conditions of this secretion which may be produced by local disease of the renal organs, by various constitutional conditions, and by disease of the brain or spinal cord; and those which depend on the modes of voiding this secretion. The former will be fully considered in Chapter XI, Section 4; the latter will now be described.

The Excretion of the Urine may be difficult, or painful, or changed, or arrested. With respect to the difficulty of voiding the urine, three grades have been distinguished: dysuria—*δὺς*, with difficulty, and *οὖρον*, the urine—in which the urine is voided with trouble or effort, pains and a sensation of heat in some part of the urethra; strangury—*στραγγειν*, to squeeze, and *οὖρον*, in which the difficulty is extreme, the urine issuing drop by drop, and being accompanied by heat, pain, and tenesmus at the neck of the bladder; and ischuria—*ἴσχω*, I arrest, and *οὖρον*—in which no urine at all can be passed.

The first two species—*dysuria* and *strangury*—should always attract attention, since they cause great suffering, and lead to conditions by no means devoid of risk, more particularly in aged persons. They may proceed—either from disease of the urinary organs or passages, as, gonorrhœa, stricture, or inflammation of the urethra; hypertrophy of the middle lobe, or inflammation of the prostate; spasm, catarrh, inflammation, or ulceration of the bladder; abscess of the perineum; and fungus or polypoid growths: from morbid states of the urine, as, the admixture of pus, blood, mucus, gravel, &c.; or from this secretion being too irritating; or from the existence of one or more calculi in the bladder or urinary passages: or from disease of the adjoining viscera, as in instances of dysentery, disease of the liver or spleen, inflamed hemorrhoids, tumors of the abdomen, and uterine or ovarian affections.

Ischuria—in which no urine at all can be passed—is divided into that of suppression, and that of retention. *Suppression of urine*—sometimes called ischuria renalis, in which no urine is secreted by the kidneys—is a most dangerous symptom, since the injurious, effete, and poisonous materials which should be excreted by the functions of the kidneys, accumulate in and vitiate the blood, and in a few days poison the sufferer. It may be caused by inflammation, suppuration, or other structural changes in the kidneys themselves; or by congestions occurring in the course of the exanthematous or other fevers; or by disease of the blood, as is seen in malignant cholera, and other pestilences; or by organic or other affections of the brain, spinal cord, or their membranes. In suppression the bladder will be found by percussion to be empty. *Retention of urine* strictly means that the urine enters the bladder, but fails to be expelled from that organ. But in its widest sense it may be said to depend upon two sets of causes; either upon some obstruction to the flow of the secretion, as a calculus, tumor, inflammation, &c., situated either at the outlet of the pelvis of one or both kidneys, or in the course of the ureter, in which case none of the urine will reach the bladder, though it is secreted and accumulates behind the seat of obstruction; or, the urine entering the bladder, there may be inability to discharge it, from—first, paralysis of the coats of this viscus consequent upon disease of the brain or spinal cord, or upon congestion of the nervous centres and paralysis of the bladder—as occurs in the course of low fevers, or from paralysis of the bladder from over-distension; or, second, the bladder being healthy, there may be some obstruction in the neck of this organ or in the passage of the urethra, the obstructing cause consisting either of an impacted calculus, or of a spasmodic or structural stricture. It must also be borne in mind that nervous anæmic women, and those who practise masturbation, often suffer temporarily from hysterical retention of urine, sometimes necessitating the use of the catheter for many days: recovery takes place as the general health improves, and the bad habits are discontinued.

Incontinence of Urine.—Inability to retain the urine—incontinentia urinæ, vel enuresis—presents different grades, varying from very frequent and irresistible calls to micturate to a constant dribbling. A frequent desire to pass water is experienced in most inflammatory affections of the urinary organs, especially those affecting the bladder; in disease of the neck of the bladder, as well as in cases in which foreign bodies are present in this viscus—as calculi, clots of blood, fungoid growths, &c.; and in many nervous affections, hysterical women especially suffering from it. The most frequent cause of a constant dribbling of the urine is paralysis of the neck of the bladder through general debility, as in aged persons; or paralysis of the lower half of the body—paraplegia; or overdistension of the bladder, producing complete loss of contractile power in the coat of this organ, so that the urine accumulating literally overflows. This latter condition is readily recognized by the dull sound elicited on practising percussion immediately over the pubes, by the pain complained of in the same situation, and by the sense of fulness communicated to the touch. Because the urine is constantly dribbling away we must not conclude that the bladder is not distended. The reverse is often the case in fevers. When blood is passed by the urine, *hæmaturia* is said to occur.

Symptoms from the Sexual Organs.—The symptoms derived from the sexual organs in the male have not received much attention. In health the penis and testes are well developed, the scrotum is firm and contracted, and the testes are drawn upwards by the contraction of the cremaster muscles. Extraordinary size of the penis is a sign of sexual excess, and in boys of onanism; irritation at the end of this organ, with continued erections—priapism—is often symptomatic of the presence of a calculus in the bladder. Erections likewise occur in inflammatory affections in connection with the bladder and urethra and even kidney, from cerebellar disease, in poisoning by cantharides, in epileptic fits; and in low fevers, in diabetes, at the commencement of all acute disorders, and in all cases of vital depression or of nervous exhaustion, the dartos is no longer corrugated, and the scrotum therefore hangs loose and flabby ; the cremasters do not contract, and the testicles, consequently, hang low down ; and there is a want of the power of erection, with loss or imperfection of the sexual desires. It is perhaps remarkable that in chronic diseases of the lungs and heart, and especially in pulmonary phthisis, the sexual powers are seldom much impaired.

The influence exerted on the mind and body of women by the wonderful nature of *the uterine system*, and the extraordinary functions performed by the latter is remarkable. The reciprocal relation existing between the uterine organs and the nervous and sanguineous systems and the organs of nutrition, is very much closer than that between the sexual system and the same organs in man. The regularity or irregularity of the menstrual flow, for example, affects the whole circle of mental and corporeal actions ; the derangements of menstruation being in some instances causes, in others results, of almost the entire class of female disorders. Amenorrhœa, leucorrhœa, dysmenorrhœa, and menorrhagia are in general merely symptoms of many opposite constitutional states ; and to look upon or treat them as local diseases is, as a rule, to commit a most pernicious error.

The amount of sympathetic irritation excited in the breasts, in the stomach and bowels, and in the nervous system by pregnancy, is always very considerable. M. Nauche states that pregnancy in general increases acute diseases, especially those involving the uterus ; chronic diseases are rendered slower in their progress and sometimes cured, and a temporary benefit is experienced in phthisis.[1] Dr. Montgomery believed that pregnancy acts in a great degree as a protection against the reception of disease, on the well-known common principle that the continuance of any one very active operation in the system renders it less liable to be invaded or acted upon by another.[2]

SECTION VI.

SIGNS DERIVED FROM THE NERVOUS SYSTEM.

The signs derived from the nervous system, which it is necessary here to consider, are not very numerous. They consist chiefly of those derived from derangement of (*a*) general sensation, as pain, &c., (*b*) of the muscular action, as from paralysis, from spasm, and (*c*) of alteration in the mental condition, as from delirium, and from coma.

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[1] Mal des Femmes, part ii, p. 690. [2] Signs of Pregnancy, p. 25.

Under the first head, or alterations of sensation, we have—

Pain.—General sensation may be deranged in two ways: it may be either morbidly keen or morbidly obtuse. When morbidly keen, it constitutes various kinds of uneasiness, which may all be classed together under the head of pain. Pain has various sources. Irritation or excessive excitement of the nervous structures or functions will produce it; so will inflammation, depression and debility, cold; and in diseases generally, the sensibility of the nerves being exalted, pain will be caused by ordinary agents, which in health would excite no sensation. A definition of pain is unnecessary, since all have suffered from it at one time or another. It is a most important sensation, since it often indicates the seat and nature of disease. It differs exceedingly in degree, in its duration and mode of recurrence, and in its character. Thus in its different grades it is spoken of as *slight*, *moderate*, *severe*, *violent*, *excruciating*, *intense*, or *agonizing*. As regards its recurrence, it may be *fugitive* or *persistent*, *wandering* or *fixed*, *intermittent*, *remittent*, or *continued*. In character, pain may be *dull*, or *obtuse*, or *heavy*, or *aching*, as it usually is in connection with congestions and chronic inflammations, or in acute inflammations of parenchymatous organs; or it may be *gnawing* and *aching*, as is the pain of rheumatism and gout, and of periostitis; or it may be of a *cutting*, *lancinating* character, as occurs in scirrhus, and in inflammation of the nerves; or it may be *griping*, or *twisting* and *spasmodic*, as accompanies dysentery, ileus, gastralgia, enteralgia, and obstruction of the intestines. When pain is attended with a beating, throbbing sensation, consequent upon the heart's action, it is called *pulsating;* when with a feeling of tightness, *tensive;* when with heat, *burning*. From this it is apparent that not only are different kinds of morbid action accompanied by different varieties of pain, but that the same kind of morbid action—inflammation, for example—produces different modifications of suffering, according as it affects different parts. Thus, in inflammation of the serous and synovial membranes, the pain is often very severe, and sharp or acute; in the mucous membranes and parenchyma of the viscera, it is dull or heavy; while in the skin it is apt to be burning, tingling, &c. So again pain often takes place, not in the organ really affected, but in some distant part. How commonly does inflammation of the liver almost first show itself by the pain it produces in the right shoulder; stone in the bladder, by pain at the end of the urethra; chronic ovaritis, by pain down the leg of the affected side; inflammation of the hip-joint, by pain in the knee; and disease of the heart, by pain down the left arm.

If pain be experienced only in a part when it is touched —when pressure is made upon it, the part is said to be *tender*. A part may, however, be both painful and tender. *Increased* pain on pressure indicates vascular congestion, inflammation, or some organic change the result of inflammation. Pain is *diminished* by pressure in colic, in chronic rheumatism, and in pure neuralgia, unless there be inflammation of the nerve or its sheath.

In forming an opinion as to the nature and degree of pain in any particular case, we must not allow ourselves to be misled by the statements of the patient. Many people are so prone to exaggerate the nature of their sufferings, and to use strong expressions in order to impress the importance of their symptoms upon the practitioner, that, to avoid being misled, it is necessary to be guided more by the expression of the countenance and the general appearance rather than by what is said. If a person, for instance, tells us in a calm tone of voice, and with a composed countenance, that he is suffering the most excruciating tortures, we shall be justified in estimating the severity of the pains to be greatly less than the terms "excruciating tortures" would imply.

Diminished Sensibility.—This may vary from slight numbness, or from local or partial loss of sensation, to total loss of sensibility—anæsthesia. Loss of sensation to *pain*, as distinguished from loss of sensation in an ordinary sense, loss of the tactile sense, anæsthesia—has been called *analgesia*. The latter may be present without anæsthesia; but when anæsthesia exists there is no sensibility to pain. The sensibility is diminished or lost in certain forms of cerebral disease—especially apoplexy, epilepsy, catalepsy, and ramollissement or softening of the brain; in certain varieties of low fever, as typhus and typhoid; and in that peculiar stupor, almost amounting to coma, which often succeeds certain forms of delirium.

Pressure upon the nerve of a limb will cause anæsthesia in the parts below the seat of pressure, and serious diseases attacking the nerves are accompanied by anæsthesia of the parts supplied by the affected nerves. It is very rarely found that the sensibility of a part is so completely lost as to be insensible to severe kinds of injury; in general, there is only a numbness of the skin. Paralysis of motion is often unattended by loss of sensibility; but when otherwise, it will generally be found that anæsthesia more commonly precedes loss of motion of the lower than of the upper extremities, and that in any instance it rarely follows paralysis of motion. Loss of sensation is detected by pinching or pricking the skin, and the degree of anæsthesia by ascertaining the extent to which points brought into contact with the skin are distinguished. In health two distinct points, such as those of the compass, are recognizable at certain distances the one from the other, which experience has taught us are "standards" for different parts of the body. In anæsthesia these points cannot be distinguished at all, or in the incomplete forms of anæsthesia, only at greater distances than is usual in health. The instrument used for this purpose has been described before.

We now come to alterations of muscular action, and foremost amongst the deviations from health is the condition termed

Paralysis.—Disease of the brain or spinal cord involving the extremities of certain nerves there originating will necessarily be followed by effects in the structures to which such nerves are distributed, and of which indeed they form an integral and necessary part. The result of such disease is paralysis or palsy, by which is meant a local or partial loss of sensibility, or of motion, or of both, in one or more parts of the body; and as the nerves contain motor and sensory fibres, the sensation and the motion of the part affected will be altered probably together. All paralytic affections may be divided into two classes—the first including those in which both motion and sensibility are affected; the second, those in which the one or the other only is lost or diminished. The former is called *perfect*, the latter *imperfect* paralysis. Imperfect paralysis is divided into *acinesia*—paralysis of motion; and *anæsthesia*, paralysis of sensibility. Again, the paralysis may be *general* or *partial*, as it affects the whole body or only a portion of it. *General paralysis.*

or complete loss of sensation and motion of the whole system, cannot take place without death immediately resulting. But this expression is usually applied to palsy affecting the four extremities, whether any of the other parts of the body are implicated or not. *Partial paralysis* is divided into *hemiplegia* when it is limited to the lateral half, and *paraplegia* when it is confined to the inferior half of the body. The term *local paralysis* is used when only a small portion of the body is affected, as the face, a limb, a foot, &c. The term *reflex* paralysis is now used to indicate that variety of paralysis which is dependent upon disease in some part not directly connected with the paralyzed part itself. It is induced through the reflex agency of the spinal cord. Paralysis may be hysterical.

Paralysis of the eye, or loss of sensibility of the retina to the rays of light, is called amaurosis; paralysis of the superior branch of the third nerve supplying the levator palpebræ superioris muscle, causing the upper eyelid to fall over the eye, is termed *ptosis;* insensibility to the impression of sounds (deafness), *cophosis;* insensibility to odors (loss of smell), *anosmia;* loss of taste, *ageustia.*

There are also certain forms of paralysis arising from the use of metallic poisons, as *mercurial palsy*, and *saturnine* or *lead palsy;* and there is a peculiar affection known as *paralysis agitans*, or shaking palsy. Modern writers have described in elaborate detail a *wasting palsy*, a form of paralysis partial or general in which the loss of power over muscles is accompanied by their wasting. In certain cases the power of co-ordinating the muscles is lost, there is a certain loss of power, but scarcely paralysis; but it is proper to enumerate the condition here indicated, which is called *locomotor ataxy*, under the head of paralysis.

Partial Forms of Palsy.—Hemiplegia is mostly seen as the result of apoplexy, and the corpus striatum and optic thalamus are the seat of disease; it is common, and affects the side opposite to that in which the brain lesion is situated. Facial paralysis of the same side as the palsied limbs is present. When the portio dura of the seventh, or facial nerve, and the third division of the fifth nerve (the two motors of the face) are involved, the whole side of the face is paralyzed; when the fifth is alone involved, mastication is interfered with, and if the patient is made to bite, the masseter will not be felt contracting.

There is no distortion of the face; when the portio dura is involved exclusively the face is drawn to one side, but the distortion is made very manifest on smiling or laughing; the power of frowning or winking on the palsied side is lost, so is that of whistling; moreover in blowing, the cheek is distended on the palsied side, and indeed there is no muscular tension at all, it puffs out on expiration, and on attempting to laugh the muscles of the non-palsied side contract and draw over the palsied side. The saliva dribbles away, the food accumulates between the teeth and the gums on the affected side, the flaccid cheek is liable to be bitten, and the labials *v*, *p*, and *f* cannot be correctly articulated. The uvula and palate are paralyzed on the affected side if the seventh is affected before the petrosal nerve is given off. When the nerve is injured in the temporal bone by disease of the petrous portion, the uvula and palate are normal. In seeking for the cause, therefore, we are guided much by the state of the palate and the existence of disease of the ear. Paralysis of the seventh may arise from cold playing upon the face. Conjoined to paralysis of other nerves (ex., the third), it shows grave cerebral mischief. The tongue is often paralyzed on one side, and, when protruded, the tip is pushed over to the paralyzed side; the ninth nerve must consequently be implicated, since that is the motor nerve of the tongue. The conditions giving rise to hemiplegia are (besides apoplexy), softening, tumor, syphilitic gummata, abscess of brain, epilepsy, and chorea (when it is temporary), hysteria, and spinal disease (very rare); in apoplexy it is sudden. In cerebral hemiplegia the intellect is disordered, and the face affected. In spinal hemiplegia the face and tongue are unaffected, and whilst there is paralysis of motion on one side, there is paralysis of sensation on the other.

Paralysis of special nerves, the fifth, seventh, and ninth, have been referred to. Paralysis of the third nerve followed by ptosis, is due to paralysis of the levator palpebræ; divergent squinting to paralysis of the internal rectus, and dilatation of the pupil is the result of paralysis of the circular fibres of the iris; when these occur together it indicates very grave cerebral mischief. The fourth nerve, if paralyzed, which is rare, is followed by double sight, and a loss of the rotation of the eye. If the sixth nerve is affected, convergent strabismus follows, the eyeball cannot be turned outwards. The glosso-pharyngeal branch of the eighth is affected in diphtheritic paralysis, and the spinal accessory in some cases of aphonia.

In facial paralysis accompanying hemiplegia, the paralysis of the muscles of the face is not so complete as it is when there is paralysis of the seventh alone. In infants hemiplegia sometimes occurs during the eruption of the permanent teeth, probably from spinal congestion. Those who write much sometimes lose the control over the muscles they use in writing. The symptoms come on gradually, until the attempt to write throws the muscles in spasm ; this is called Scrivener's Palsy.

There are other disorders of muscular action, but these will be noticed under the head of spasm. Now paralysis is really mostly only a symptom, as it depends on disease of the nerves or cerebro-spinal system. The power of contraction exists in the muscles, but the nerves fail to transmit the necessary stimulus or to excite the muscles to action. In some cases, however, the muscles possess no power in themselves of contracting, as in lead palsy, hence the value of electricity to detect the nature of the paralysis. The sure consequence of paralysis of long standing is fatty degeneration and wasting of the muscles, rendering recovery of muscular power impossible.

Spasm.—Under the term spasm are arranged all involuntary muscular contractions—convulsions is the general term—and they are divided into two classes, *tonic* and *clonic*. This division is still generally adopted.

Tonic spasm—called by Cullen spastic rigidity—is characterized by a long-continued contraction of the affected muscles, alternating with relaxation, the relaxation taking place slowly and after some time, and being quickly followed again by contraction. A very familiar example of tonic spasm is the common cramp of the leg. So also it is the principal symptom of trismus or lock-jaw, tetanus, catalepsy, and poisoning by strychnia. In *clonic spasm*, the contractions of the affected muscles take place repeatedly, forcibly, and in quick succession ; and the relaxation is, of course, as sudden and frequent. Illustrations of clonic spasm are found in convulsions of all kinds, in the rapid convulsive movements of epilepsy, of hysteria, chorea, &c., in delirium tremens, in the convulsive twitchings seen in low fevers, and called *subsultus tendinum*, and in the picking at the bedclothes in typhoid states. Occasionally we see the two forms of spasmodic action occurring in the same individual at the same time, some muscles being convulsed or affected with clonic spasm, while others are affected with rigidity or tonic spasm. The *exciting causes* of spasm are chiefly influences affecting the nervous centres, the mind, the senses, the digestive viscera, and the urinary or sexual organs. The *immediate cause* is supposed to be irritation of the nerves supplying the affected muscles, either at their origins, or in some part of their course, or at their terminations ; or else a sympathetic affection of these nerves propagated from distant but related parts by reflex action. *Chorea*, referred to above, occurs in young girls oftentimes from fright, and the irregular muscular movements are first seen in the face ; the patient cannot help making grimaces; the arms and legs soon get affected ; and ordinary movements are awkwardly made ; the walking consists of a series of jerking shuffles ; the speech is affected ; the tongue put out sharply and quickly drawn in. The movements cease or abate in sleep ; rarely imbecility is the final result. Dr. Hughlings Jackson thinks the disease is due to capillary embolism in the corpora striata and adjoining convolutions. In tetanus, the first symptoms are those of stiff neck and sore throat, which increase till the jaw is "locked," by the spasm of the muscles, and swallowing is difficult. This tonic spasm presently involves the muscles of the face, generally the arms, whilst there are terrific cramps in them every now and then. The back is arched by the violent contraction of the muscles (*opisthotonos*), or bent the reverse way (*emprosthotonos*), or sideways (*pleurosthotonos*), respiration is interfered with, and collapse soon comes on.

Delirium.—Delirium has been divided into the *acute* and *chronic;* the former consisting of various morbid states of the brain or blood, attended by mental disturbance and fever,—the latter of mental alienation, unattended by fever or active bodily disorder. Chronic delirium therefore comprises those states of disordered mental manifestation known as insanity.[1] Acute delirium is more common in the severe affections of the young than of the old, and in diseases occurring in individuals of a nervous temperament rather than in those of the sanguine. It is said to be active or passive ; the former —as a rule having many exceptions—being characteristic of the existence of inflammatory action, hence the term febrile delirium ; the latter, under the same circumstances, resulting from exhausted nervous and vital power. The *active* differs greatly in degree, being sometimes mild, sometimes violent or furious ; in the mild form there is generally mental abberation without any disposition to action ; in the furious grade, there is violence of manner, voice, and language. In *passive* delirium the mind appears to be wandering ; the patient mutters sentences without meaning, but will answer questions coherently and correctly if roused, or if the circulation be quickened by a stimulant : the low muttering wandering of typhus is a good example of this form of delirium.

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[1] See "Copeland's Medical Directory :" Article Delirium.

In inflammation of the brain the raving is often very violent. Cases of encephalitis, characterized by *early and fierce* delirium, are generally those in which the inflammatory action has invaded the whole of the encephalon, cerebral substance, and the meninges simultaneously. When delirium occurs during the progress of a case of pneumonia, it is a very ugly symptom, since it generally denotes that the pulmonary affection is largely interfering with the due arterialization of the blood. Delirium tremens is a compound of delirium and tremor, and is generally characterized by a busy, but not angry or violent delirium, by hallucinations.

Coma.—Coma is that condition of complete insensibility in which the functions of animal life are suspended, with the exception of the mixed function of respiration ; while the functions of organic life, and especially of the circulation, continue in action. There is neither thought, nor the power of voluntary motion, nor sensation ; but the pulmonary branches of the par vagum continue to excite, through the medulla oblongata, the involuntary movements of the thorax. When this upper part of the cranio-spinal axis becomes involved in the disease, and its reflex power ceases, the breathing stops also, and the patient is presently dead.

On being called to a case of deep coma there will often be experienced great difficulty in deciding whether this condition is due to apoplexy (see general remarks on brain disease), or to a large dose of opium, or to a poisonous quantity of alcohol. All physicians engaged in hospital practice have seen cases in which they have been placed in this dilemma—a most unhappy one, since the life of the sufferer may depend upon the correctness of the diagnosis. The points which will assist the practitioner in forming an opinion are, the history of the patient, his general appearance, and such other circumstances as can be gleaned from his friends, or those persons who picked him up in the street; the smell of his breath, the odor of tobacco, of spirits, or of wine, being often easily detected; his condition in life; and the state of his mind for the previous few days. In cases of poisoning by opium, however, the pupils are almost invariably contracted, sometimes to the size of a pin's point; in deep intoxication they are often dilated, but sometimes contracted; and so in apoplexy. The diagnosis of intoxication is often difficult, for though the odor of the breath is one of the best means of throwing light on the case, yet it must be remembered that a fit of apoplexy or epilepsy is very likely to occur in a plethoric predisposed person after a glass or two of spirits.

Headache.—It is usual to describe four kinds: the first, the *organic* headache, is due to serious brain disease; in it the pain is sharp, often confined to one spot, and accompanied by vomiting and constipation and other signs of cerebral disturbance. It must be distinguished from neuralgia, syphilitic disease, or rheumatism of the scalp. The second variety is the *plethoric* headache. This is not acute but is rather a sense of fulness; there is surging in the head, giddiness in moving, and the face is full of blood. The third is the *bilious* headache. It occurs in connection with stomach derangement, or some excess, as evidenced by foul tongue and breath, epigastric pain, nausea, disordered bowels, &c. The fourth is the *nervous* headache, which results from exhaustion of all kinds: it may be neuralgic; over-lactation, hemorrhage, worry, and hysteria cause it.

Vertigo, literally a turning round or giddiness, is a common symptom. It is usually succeeded by headache. The patient attacked with vertigo may fall, but he usually staggers and saves himself by grasping some object. Vertigo in a slight degree may result from stomach derangement, heart disease, or albuminuria; but when it is severe and recurs, it is suspicious of serious brain disease. It occurs in epilepsy, cerebral congestion; it may precede apoplexy; it is present in alteration of the structure of the brain.

CHAPTER VI.

ON THE DIAGNOSIS OF NATURAL FROM FEIGNED DISEASE.

In every age and in every country disease has been simulated by all classes of society. Numerous examples to prove the truth of this assertion might be quoted from the Scriptures as well as from ancient and modern history, but such instances would prove more entertaining than useful. Suffice it to say that the monarch, the statesman, the priest, the soldier, and the criminal have alike feigned mental and bodily infirmities for the advancement of their own ambitious or nefarious designs. In the present day the majority of these impostors are found amongst persons suspected of crime, vagrants, sailors, soldiers—a soldier feigning illness is said to be *malingering*—members of benefit societies, children, and such hysterical and capricious women as, having no healthy occupation, amuse themselves by simulating cardiac, pulmonary, spinal, or uterine disease. There are others who feign disease to excite pity, or to extort charity, or to claim heavy damages for slight ailments.

In the investigation of this class of cases great discrimination and ingenuity will be required, since the actors in these deceits generally play their parts with considerable skill, and often with a total disregard to trouble or even physical suffering. There are four modes in which disease may be said to be simulated: 1. Disease may be altogether feigned, the person being in a state of health. 2. It may be exaggerated—that is to say, there being a certain amount of disease, the patient may pretend that it exists in a greater degree and causes more disturbance and suffering than it truly does. 3. Disease may be artificially excited, sickness being actually produced either by the patient, or with his concurrence.[1] And, 4. Disease may be artificially increased or aggravated during its course.

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[1] Robertson, in his "History of Charles the Fifth" (book xi), tells us of Pope Julius III, who feigned sickness to avoid holding a consistory, and, in order to give greater color to his imposture, confined himself to his apartment, and changed his usual diet and

Some admirable general rules are laid down by Caspar (see the Syd. Soc. translation of his work on "Forensic Medicine"). They are briefly as follows : (1) In a doubtful case do not be content with a single examination; but make a sudden visit to the supposed feigner even a short while after the first: he may be caught off his guard—ex., the bedridden may be up and about. (2) Observe the patient when he is unaware that he is watched. (3) Compare the patient's statements with known medical facts. (4) Artfully ask if a series of symptoms exist—the more extraordinary the better—which have not the slightest connection with the alleged disease. Caspar instances double vision, both thumbs going to sleep, a desire to go to stool regularly every night at midnight, occasional hemorrhage from the left ear, &c., as a combination that might be acquiesced in, and at once determine the matter. (5) Cross-examine the malingerer in such a way as this: If he has obstructed bowels that nothing will relieve, say of course you never have a diarrhœa, &c. This "makes the lie to falter." (6) Suspect those who describe dozens of ailments, and cannot find words to express what they suffer. Hysteria is of course excepted. (7) Examine fully the disease said to exist on parts ordinarily covered. (8) Be not deceived by bandages, splints, or the like, by recent blistering or cupping, &c. (9) Place little importance on the statements of comrades, relations, &c. (10) The effect of pseudo-physic may be watched; give bread-pills, for instance, and see if the cure is ascribed to it. (11) The malingerer may be threatened by repulsive or unpleasant methods of cure, by the display of instruments for pretended severe operation; or, as Caspar puts it, "There is nothing else for it, but for the physician to pit his own cunning and skill against that of the malingerer." Dr. Woodman, in the *London Hospital Reports*, vol. ii, p. 257, has a very good chapter on this subject. This gentleman believes that nearly all who feign disease or accidents are really in some way or other in ill health, or in other words that a basis of truth un-

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manner of life. So effectually, however, did he play his ridiculous part, that he contracted a real disease, of which he died in a few days.

derlies most attempts at malingering. But there is one more important consideration, and that is, in all cases of feigned disease to ascertain the general moral tone and mental qualities of the suspected malingerer, whether he help to cure his malady by taking his medicines regularly, and what object he can gain by deception.

The accompanying table exhibits the diseases which are most frequently simulated, the mode in which they are feigned, and the means to be adopted for their detection.

In considering the facts narrated in the table we find much to excite not only our wonder but our regret; and without indulging in any morbid or sentimental feelings, we think it impossible not to come to the conclusion that many, especially in civil life, who practise the deceptions detailed, at least do so from folly and mental imbecility, as much as from vicious and wicked motives. In treating such cases, therefore, it is not for us at once to condemn or assume too harshly the character of judges. The constant practice of our profession makes us acquainted with so much that is morally blamable, and teaches us so forcibly the weakness of man and the proneness of the best of us to err and trespass—for there is no "happy valley" where sin and sorrow are unknown, save in the fiction of Rasselas—that we cannot but pity those who come under our care from diseases self-inflicted or even simulated. Although, consequently, the conscientious practitioner will not allow himself to be imposed upon, yet he must not rest satisfied with merely discovering the deceit; but remembering that the quality of mercy is such that it "blesseth him that gives and him that takes," and bearing in mind how much we all stand in need of a merciful interpretation of our daily conduct, he will readily learn to make allowances for those who have succumbed to temptation; and by kindness, gentle reasoning, and attempting, as far as in him lies, to smooth their path of life, endeavor to lead them to a more healthy tone of thought, and to teach them that however exalted or however humble their occupation, still if they do their duty in it to the best of their abilities, they must prove useful and valuable members of society, and will be rewarded accordingly.

A TABLE OF FEIGNED DISEASES.

DISEASE.	MODE OF SIMULATION.	MODE OF DETECTION.
1. Abdominal Tumors.	By paddings worn in the dress; by pushing the abdomen forward while in the erect position; and by elevating the spine when lying on the back. Also by making the recti muscles rigid. In the "Dictionnaire des Sciences Méd.," a case is mentioned of a young soldier who produced abdominal distension by swallowing air: "par le moyen d'éructations bruyantes et non interrompues, par haut et par bas," he got rid of his tympanitis at will. Allowing constipation to continue many days might cause such a collection of fæces as would assume the feel of a tumor.	Examine the abdomen uncovered, and produce relaxation of the muscles, by raising and drawing up the patient's knees. Administer nauseous anti-flatulent purgatives.
2. Abortion.	By staining the clothes and body with blood.	A vaginal examination: appearance of the areolæ around the mammæ, &c.
3. Abstinence.	Often feigned for exciting wonder or pity. One well-known case of the kind was that of Elizabeth Squirrell, of Shottisham, in Suffolk, who, in 1852, led her neighbors to believe that she had lived solely upon air for rather more than four months. Instances of abstinence protracted for some days are not rare. Thèvenot asserts that the Arabs can remain five days without food, and other authorities report that the Tartars support abstinence for sixteen, seventeen, or even eighteen days. Cheyne states that a phthisical patient lived thirty days upon water with a little nitre in it. A prisoner at Toulouse determined to starve himself: from the 15th April, 1831, to the 17th June, when he died, he drank only a little water, and sometimes his urine, taking nothing else whatever. Magendie's experiments upon animals belonging to genera near to man, show that they cannot support life without food or drink, beyond fourteen or fifteen days.	Very difficult of detection. Attentive watching, and trouble to a greater extent than the cases merit, must be trusted to.
4. Aphonia.	Partial loss of voice is very rarely feigned, which is somewhat remarkable, since the simulation would be very easy, and the mode of detection difficult. True aphonia generally results from tume-	The impostor may be suddenly awoke in his sleep, or placed in a room alone and his fears excited, when he will probably involuntarily

DISEASE.	MODE OF SIMULATION.	MODE OF DETECTION.
	factions of glottis and fauces, from relaxation of the chordæ vocales, from tumors of neighboring parts compressing the trachea, and from mechanical division or paralysis of the nerves distributed to the tongue and larynx. It somtimes precedes, sometimes succeeds, apoplexy.	make an exclamation. By the absence of any physical cause, which could be easily detected by the laryngoscope. See *Gavin on Factitious Diseases.*
5. Apoplexy.	By falling down suddenly, as if deprived of sensation and consciousness, and lying as though dead.	Powerful stimulants, sternutatories, electric shocks, &c. The use of the actual cautery may be proposed in the impostor's hearing.
6. Asthma.	Difficulty of breathing, increased on making any exertion; cough; expectoration; palpitation.	The stethoscope will detect the presence or absence of disease. Watch the patient, unseen by him.
7. Blindness.	Amaurosis is the form generally assumed, which, being mostly characterized by a fixed and dilated pupil, this condition is obtained by the use of belladonna or its alkaloid atropine. Montaigne tells us of a Roman who put a plaster over one eye, to counterfeit blindness; after wearing it some time, he discovered, on removing it, that he really had become what he had feigned to be.	Watching the patient, without his knowledge. Where belladonna has been used, we must wait for some days—even nine or ten,—until its effects have ceased, putting supplies of this agent out of reach. The non-amaurotic eye will unconsciously follow, or the head will slightly turn towards the object actually seen. The perfectly lifeless glance of the eye, the absence of any attempt to fix it upon any object, a certain repose in the whole demeanor, a frequent blinking and shutting of the eyelids,—all this, says Casper, would require an adept, rendered skilful in the imitation by a careful study of the original, and such a one is not readily found. Ophthalmoscopic examination would detect serious organic disease. Von Graefe thus detects alleged unilateral amaurosis: "A prism, with its base looking upwards or downwards, is held before the healthy eye, and the suspected is asked whether he sees a candle, held in front

		of it, single or double. If he sees two candles placed one above the other, which move towards each other, following the turning of the prism, the one of these certainly originates in the other eye, and the cheat is discovered. The American surgeons, during the recent war in their country, detected the would-be blind man by telling him that they must accompany him to a place where his eyesight would be tested, and taking him up and down stairs, over logs, boxes, and impediments of all kinds, and if he avoided these, his blindness was not considered sufficient to unfit him for military service.
8. Cachexia, Emaciation, and Debility.	Cachexia Africana, or pica Africanorum, formerly produced the most extensive ravages amongst the West Indian slaves. It is generally a compound of real and factitious disease, the disorder of the stomach perhaps prompting to the practice of dirt-eating. The disease is truly a cachexia producing pallor and emaciation, and subsequently dropsy. General debility is sometimes produced by drinking freely of spirituous liquors, and by foregoing sleep for a time prior to examination.	By examining the matters vomited after the exhibition of emetics, or by inspecting the stools, which will be found to consist chiefly of the earth swallowed. Debility from other causes will be discovered by retaining the party under observation.
9. Calculi in the Bladder.	Young women and others will introduce cinders, pieces of bone, and common gravel, &c., into the vagina, and even into the urethra and bladder, to simulate this disease.	Easily detected by removing and examining the foreign substance.
10. Cancer.	The smooth surface of half of the spleen of an animal has been glued to the skin, giving the appearance of a malignant ulcer.	A careful examination will alone suffice.
11. Catalepsy.	Has been feigned, generally in some of its imperfect varieties, by soldiers, sailors, and hysterical masturbating women.	Propose the use of the actual cautery. John Hunter suspended from the stretched-out hand, a string, with a small weight attached to it, and suddenly cutting the thread, observed whether the arm was abruptly raised, as it would be by an impostor.
12. Chorea.	By assuming those constant, absurd, convulsive movements which characterize the disease. It requires good acting to imitate this affection closely. Baglivi, who states that symptoms similar to those of chorea arise from the bite of the tarantula or venomous spider,	Watching the patient without his knowledge. Suddenly awakening him, and observing if the movements at once commence. The patient's description of his ailment is extravagant.

DISEASE.	MODE OF SIMULATION.	MODE OF DETECTION.
	asserts that women frequently counterfeited this affection in order to enjoy the music and dancing provided for those really afflicted with it.	
13. Convulsions.	In the west of Scotland, in 1742, attacks of convulsions—occasioned by religious excitement and enthusiasm—became almost epidemic. Such was also the case in Cornwall in 1813 and 1814. Many of the Jansenists—the Methodists of France—who made pilgrimages to the grave of Deacon Paris during their persecution in 1724, and were there seized with fits, were doubtless impostors; but it cannot be denied that many credulous zealots actually worked themselves into convulsions by the force of their imaginations. Nervous convulsive movements of the muscles of the face and other parts of the body are often feigned.	The stiffness of the muscles, and the resistance and rapidity of action which appear in the real disease, are absent. Watch the suspected person without his being aware of such surveillance; he will seldom persist in making irksome movements, when no advantage is to be gained by the performance.
14. Cutaneous Eruptions.	An ointment of tartar emetic, croton oil, &c., will give rise to a pustular eruption, which, after a few days, will slightly resemble impetigo. A young woman in King's College Hospital, during the author's house-physiciancy, produced a very good imitation of pompholyx by the inunction of powdered cantharides. Urticaria will often arise from eating shell-fish, bitter almonds, &c. So called "white gangrene of the skin," is produced by hydrochloric acid; gangrene is produced by tight ligaturing of a part.	Careful examination and search for the particles of cantharides, &c. Ulcers produced by irritants will get well if they are covered over in such a way that they cannot be tampered with without detection.
15. Death.	Cardan tells us of a priest who could simulate death at will, with no sign of respiration, and in whom no appearance of sensation could be produced by pricking, tickling, or burning. Dr. Cheyne, in his "English Malady," states that the Hon. Colonel Townsend was able, voluntarily, so to retard or stop the functions of respiration and circulation, that the action of neither could be perceived. In the "Memoirs of Vidocq," mention is made of a prisoner who counterfeited death so well and so often, that when he actually expired, two days elapsed before the jailers were convinced and would remove his iron collar.	By the deficiency of the respiratory movements, the cessation of the motions of the heart, and by the complete loss of tone and irritability. In doubtful cases, therefore, hold a fine feather, or the flame of a candle, before the nose and mouth, auscultate the heart, and try if blood will flow on opening a vein. Irritants, moreover, will not redden the skin in the dead. Dr. Josat ("De la Mort et de ses Caractères") concludes from his researches, that there is no single sign of death which can be

		regarded as conclusive except putrefaction; which opinion appears to be borne out by M. Deschamps ("Du Signe Certain de la Mort"), who regards green discoloration of the abdomen—the first sign of decay—as a certain sign of death.
16. Deafness and Deaf-Dumbness.	Impostors generally lose their hearing suddenly, whereas the real disability takes place gradually. Occasionally, deafness is caused by inserting a pea or other foreign body in the ear. The gestures and expression of countenance of the deaf and dumb are difficult to assume. All our readers must remember the pretended deaf mute described by Sir Walter Scott, in his Introduction to "Peveril of the Peak," who acted her part so well, for three or four years, that she remained unsuspected until one Sunday—coming suddenly upon a boy appropriating a nicety to which he was unentitled—she exclaimed, "Ah, you little devil's limb!"	Examine the ear. Deaf people require you to speak slowly and distinctly, and do not speak in a natural voice, but either too loud or too low; only impostors demand that you shout when addressing them. Place the patient under the influence of chloroform: during its exhibition, or as its effects are going off, the impostor will in all probability declare himself. One may sometimes outwit them by speaking very loud, and then suddenly saying something on which they are touchy, or which is disagreeable, suddenly in a low tone.
17. Deformity.	The deformities and malformations most frequently simulated are contractions of the finger, elbow, ankle, and knee-joints; shortness or distortion of the limb; inversion of the feet; curvature of the spine; wry-neck; and dislocations. A convict at Woolwich shirked his work, by keeping his right knee bent, so as not to touch the ground with his foot, for the whole period of his punishment, seven years: at the end of this time, on being discharged, he impudently remarked: "I will try to put down my leg, it may be of use to me now." He did so, and walked off with a firm step. Several cases have been reported of females who have produced serious swellings. abscesses, &c., by the introduction of numerous needles into the parts.	For pretended contractions of the muscles or joints, a tourniquet should be affixed above the affected part, and tightened to an extent sufficient to render the muscles incapable of acting; the joint will then be found easily movable. In the same way, factitious shortening of a limb from any cause may be detected: or the limb may be straightened while the impostor's attention is withdrawn, or while he is under the influence of chloroform the whole limb should be examined. In dislocations, the relations of surrounding parts, the state of the muscles, whether they be wasted from disease or not, and the use of chloroform so as to relax the muscles and enable the possible motions of the limb to be determined, will suffice. Indeed, in all deformities that are simulated, chloroform will aid in their detection as in dislocations.

Disease.	Mode of Simulation.	Mode of Detection.
18. Delivery.	After the existence of artificial abdominal enlargement, and the sudden subsidence thereof, it has been pretended that delivery has taken place, either for the purpose of extorting charity. compelling marriage, or disinheriting parties who have claims to an estate. The external parts of generation are moistened with borrowed blood, and the infant of another substituted as the female's own.	After real delivery the vagina will be found relaxed, as will the os uteri—which is also tumid and tender; there will also be a lochial discharge. Beyond the sixth day it will be difficult to draw any conclusions from a vaginal examination. The areolæ around the nipples will be very dark; and the breasts should contain milk. The abdominal integuments are also flaccid, and present a peculiar appearance for several days after labor.
19. Diarrhœa and Dysentery.	Are often feigned, especially by soldiers and sailors in warm climates. Mr. Hutchinson states that he has known convicts break down in their urinary utensils a healthy evacuation, and intimately mix it with the urine, so as to imitate a diarrhœa stool, or add blood to it, procured by pricking the gums, so as to simulate dysentery. Vinegar and burnt cork have been employed to the same end. Mucous discharges are produced by introducing suppositories of soap or of some more irritating substance into the rectum; blood is sometimes subsequently mixed with these. Sulphate of iron is occasionally taken to render the stools black and unhealthy-looking.	The patient must be made to use a night-chair, his proceedings must be closely watched, and care must be taken that he does not obtain blood by pricking his gums, nose, &c. In diarrhœa the linen is stained oftentimes.
20. Dropsy.	The French conscripts are said to have actually injected water into the peritoneum, and thereby produced factitious ascites. Anasarca of the extremities has been frequently caused by ligatures artfully concealed. Several instances have been mentioned of mendicants who have daily blown air under the scalp of children through a small opening at the vertex, giving rise to great distension simulating hydrocephalus.	When a ligature has been applied, it will always leave a mark, at once telling the tale. A careful examination will generally detect the other impositions.
21. Dyspepsia.	Marshall says that many men have been discharged from the army in consequence of real or simulated dyspepsia When feigned, we shall seldom find all the symptoms present, neither will the general health appear to suffer in a proportionate degree. Some persons can vomit at pleasure, by pressing on the region of the præcordia, and	Difficult of detection, and often impossible where there is a certain amount of disease with great exaggeration. It may probably be advisable not to discharge any man from the army or navy for dyspepsia, unless we are con-

	they avail themselves of this faculty when simulating disease of the stomach. They also privately supply themselves with food which they do not vomit.	vinced there is some organic disease of the stomach or viscera.
22. Dyspnœa.	Difficulty of breathing alone is seldom simulated.	Watch the person when asleep.
23. Ear—Diseases of.	Those diseases of the ear which produce a discharge (otorrhœa) have been *simulated* by putting honey, or pus, or rancid tallow, &c., into the external meatus; they have been *excited* by introducing powdered cantharides or other acrid substances.	Careful examination will alone be necessary.
24. Epilepsy.	A feigned attack of epilepsy always occurs at some opportune time and place; the convulsive contractions do not take place simultaneously over different parts of the body; the impostor opens his eyes occasionally to observe the effect of his acting upon the bystanders; he cannot produce the contorted face, and red, bloated countenance of the true epileptic; the skin becomes hot and covered with perspiration, whereas in real cases it is generally cold and clammy; and the termination of the disease is abrupt. the stupor, vertigo, and succeeding exhaustion being imperfectly evinced in the simulated disease. Foaming at the mouth is often produced by a piece of soap kept under the tongue. In the feigned disease the impostor makes no attempt to conceal his malady, and courts publicity: with the real epileptic it is always the reverse, he being anxious to hide his infirmity.	There are spasms of the muscles of the eye; the iris is insensible to light; the heart's action is irregular; the respiration is peculiar. Mr. Hutchinson completely cured a malingerer by blowing a quillful of fine Scotch snuff up the nostrils, which produced a violent fit of sneezing. The fear of pain or danger, excited by the proposal of an operation in the patient's hearing, will often cut short a feigned attack. In doubtful cases. the practitioner must be very guarded in giving an opinion, and should never sanction recourse being had to punishment.
25. Fever.	This disease may be feigned, or artificially produced Foderé states that some persons can readily simulate fever, being able to produce great frequency of pulse, chattering of the teeth, and deep sighs. In order to give an unhealthy appearance to the tongue, it has been covered with soap, flour, chalk, dust, pipe-clay, brickdust, tobacco, whitening from the walls, &c. Redness of the skin has been produced by friction with a hard brush. Fever may be really temporarily produced by brandy, wine, tobacco, cantharides, &c. Ague is sometimes simulated, but the exertions of the individual convert the cold into the sweating stage.	Where the febrile paroxysm is due to intoxication, &c., it is only ephemeral, and one or two days' examination develops the deceit; in fact, all feigned fevers are ephemeral. Should the tongue be artificially coated, rinsing the mouth with warm water will clean it. The general condition of the system will be found incompatible with the truth of the symptoms.
26. Fistula in Ano.	Has been feigned by making an incision near the margin of the anus, and introducing an acrid tent into it. The courtiers of Louis XIV feigned fistula in ano, in order to resemble their sovereign; and coming under the hands of ignorant surgeons, who pierced the intestine, they really acquired the disease.	The parts must be carefully examined.

DISEASE.	MODE OF SIMULATION.	MODE OF DETECTION.
27. Hemorrhages.	Hemorrhages from the lungs, stomach, or kidneys are often simulated. *Hæmoptysis* is feigned by coughing, and coloring the saliva with blood from the gums, or with some foreign substance, as vermilion, Armenian bole, brickdust, by scarifying the throat or nares, &c. Factitious *hæmatemesis* has been produced by swallowing bullock's or other blood, and then causing vomiting. Sauvages relates the case of a girl who—to escape from a convent—brought up, in the presence of the physicians, several pounds of blood, on several successive days: it was at last discovered that she secretly drank bullock's blood before the expected visit. Casper notices the deception of a woman who was supposed to have vomited blood just before being sent to Bridewell. The evidence was a handkerchief *saturated* in blood, but there was not a spot where no blood existed, as is usually the case: the handkerchief had been *dipped* in blood, and the microscope showed it to be that of the pigeon. An infusion of logwood has been used. Hæmaturia has been simulated by taking substances which have the power of reddening the urine, as the fruit of the prickly pear. madder, beet-root, cochineal, logwood, black cherries, &c. Blood has also been mixed with the secretion after it has been voided; and has even been injected into the bladder.	A careful examination of the patient by the stethoscope, of the symptoms. and of the sputa, will detect the deceit. The patient must also be watched, and care taken to prevent the possibility of his obtaining the materials necessary for the simulation. The microscope determines whether the blood is human or not.
28. Hæmorrhoids.	The discharge of blood from the anus is readily feigned. Hemorrhoidal tumors have been constructed of the bladders of fish, &c., inflated, tinged with blood, and introduced into the rectum.	No medical man will be deceived by these artifices.
29. Hepatitis.	This affection is frequently simulated by soldiers in India, wishing for their discharge; and as they are aware of the symptoms, and learn to tell a consistent tale, there is some difficulty in detecting the imposition. Dr. Cheyne says: "When men who have not been in warm climates obstinately complain of pain in the right hypochondrium, and when we cannot discover any enlargement or fulness of the liver, when the pulse and breathing are undisturbed, the secretions and excretions natural, and when the alleged pain	The countenance and general appearance will be found at variance with the oral testimony. The absence of enlargement of the liver will be suspicious, though serious disease may exist without it.

	resists topical bleeding and blistering, and mercurial purgatives, the sooner we send them to duty the better."	
30. Hernia and Hydrocele.	Both of these diseases have been simulated by inflating the cellular tissue of the scrotum with air. Some men have the power of retaining the testes in the groins by the voluntary action of the cremaster muscles, and so give rise to a swelling, which has been mistaken for hernia.	Detection is easy.
31. Hydrophobia.	MM. Percy and Laurent mention the case of a conscript who feigned hydrophobia, and at first misled the examiners, but who was cured by the threat of suffocation between two beds.	The case related suggests the course to be taken.
32. Incontinence of Fæces, &c.	Incontinence of fæces and of urine has been simulated, to obtain discharge from the public service. Dr. Cheyne alludes to an English regiment in which impositions of this kind were common, owing to the ease with which the soldiers found themselves able to impose upon the regimental surgeon.	If the sphincter ani contracts upon the finger, and the fæces are still passed involuntarily after a dose of opium and solid food, there can be no doubt as to the presence of imposition. Hutchinson has suggested that the man supposed to be suffering from incontinence of urine should be placed in clean sheets after a large dose of opium at night; if the sheets be dry the next morning, the case is to be regarded as decisive. Fallot advises the waking of the patient to make water every hour or half hour during the night, when, if a malingerer, he will soon be tired out. Both these methods are open to objection. The introduction of the catheter is a very unpleasant proceeding for the cure of shamming. Casper says that when actual incontinence exists for any length of time, the meatus urinarius is always damp, and gets so at once after being dried, the whole parts about the genital organs are reddened and irritable, and exhale a urinous odor, which cannot be voluntarily prevented. It is only necessary, therefore, to examine the patient unexpectedly, when he is found to be soiled and stinking with urine, if this disease is real.

DISEASE.	MODE OF SIMULATION.	MODE OF DETECTION.
33. Insanity.	Madness is often feigned by those accused of crime. In general, the part is overacted, the person does too much, is too violent, or too simple. and betrays himself not only by inconsistencies of conduct and language, but by forgetting his feigned character when awaking from sleep, or when he deems himself unseen. The attack. too, is in general sudden, without any obvious cause; there is no history of a tendency to insanity; and the previous conduct to neighbors, &c., has been rational. In true insanity, the madman will not allow that he has any mental or corporeal disease; he will regard your visits as intrusions; and he will often talk rationally on many subjects. The impostor does all he can to make you believe he is mad; he is violent and incoherent: he talks absurdly on all topics; and he makes exertions which fatigue him, though the true maniac knows not fatigue until thoroughly prostrated. A maniac sleeps but little—an impostor soundly; the former often refuses food—the latter seldom. In the insane, the bowels are torpid—as a rule, the pulse frequent and feeble, and there is a disregard to the affections, comforts, and decencies of life. The expression of countenance of the insane, moreover, can be but feebly mimicked.	Observe when the insanity was first assumed: it will generally be *after* the commission of crime, and *after* the individual has been suspected. Watch the person frequently, and unseen by him. Low diet, solitary confinement, and repeated counter-irritation will sometimes tire the impostor. The indications and characters of mental alienation ought to be carefully studied by every medical student in a large asylum; knowledge so gained will aid him in detecting feigned insanity more than all the precepts we can lay down for his guidance. The idiot is deformed generally, has a small misshapen head, and ill-formed features, squinting eyes, large gaping mouth, with thick lips, irregular teeth, and sallow, unhealthy complexion, and an awkward and unsteady gait, as Dr. Guy has it. This is difficult to simulate. So with the imbecile, with "the stupid, vacant, wandering look, the unsettled and uneasy manner, the disconnected and evanescent ideas, the variable temper and spirits, the sudden gusts of passion, and the foolish and childish acts." The real monomaniac does not parade his delusions, but the reverse.
34. Jaundice.	A yellow color has been given to the skin, by tinging it with infusion of turmeric; muriatic acid has been used to make the stools clay-colored; and rhubarb, to heighten the color of the urine. Spirits have also been taken largely to produce heat of skin, disordered tongue, and rapidity of pulse.	Washing the skin removes the coloring matter, and the excretions become healthy on cutting off the supplies of acid, &c. Moreover, the white of the eye cannot be colored by art. The urine stains linen yellow, and this color is made somewhat greenish by muriatic acid.

35. Menstruation.	By staining the body linen, napkins, and organs of generation with borrowed blood.	By cutting off the supply.
36. Ophthalmia.	Soldiers and others have produced ophthalmia, by rubbing the conjunctivæ with gonorrhœal matter, copper, nitric acid, cantharides, sand, pepper, powdered corrosive sublimate, alum, salt, snuff, lime; by sand or other hard bodies, and by pulling out the eyelashes The right eye is most frequently tampered with, since it is the most important in using the musket or rifle.	The patients must be secluded and watched. When—as in the navy—seclusion is impracticable, a strait-waistcoat has been used to prevent applications being made to the eye.
37. Pain.	Neuralgic, rheumatic, and other pains are often simulated, and detection is difficult. A remarkable case is recorded of alleged pain in the mamma, in a female mendicant, who went so far as to solicit, and actually obtained, amputation of first one breast and then the other. She then wished a hand removed. but the imposture was discovered A ludicrous case of simulated toothache is recorded in "The Gold headed Cane:" "The conversation having turned on Russia, the Prince spoke of a certain courtier there, who, when Biron was disgraced, said, 'Ay, that fellow was the cause of my losing two of my teeth.' 'How so?' said somebody. 'Why, because a dentist came here whom he patronized; and, in order to pay my court to Biron, I sent for that man to draw two of my teeth.'"	Listen attentively to the patient's narrative, examine the part complained of carefully, cross-examine him with apparent good faith and simplicity, and he will admit the existence of any symptom, however absurd. Where the case is not clear, however, it is always better to act as if the sufferings were real. The relation between the pain, if severe and prolonged. and some serious disease can be traced out. Severe pain is incompatible with good appetite, sound sleep, and no loss of flesh.
38. Palpitation.	Heart-affections have been often simulated. White hellebore, in ten or twelve grain doses, has been employed to produce vomiting, purging, syncope, nervousness, and palpitation. In one instance, a ligature was bound round the neck so tightly, that a livid and swollen countenance and disordered action of the heart resulted.	The patient must be examined both by inspection and auscultation. He must be prevented from obtaining any deleterious drug. Men frequently presented themselves for examination with asserted "heart disease," in the American War. after having undergone violent physical exercise. The fraud was detected by allowing them to sit quietly and wait for half an hour or so, when a careful examination found the heart acting normally.
39. Paralysis.	It is necessary to distinguish between paralysis of motion and sensation. It is always a suspicious circumstance, in healthy adults, when the loss of power is confined to a single limb—the arm, for example—as such a form of paralysis is rare. In a case detected by Dr. Cheyne, his opinion that the disease was feigned was founded on the following considerations, viz.: there existed no	Feigned palsy has been detected by subjecting the patient to a powerful electric shock. A case occurred in the New York State Prison which resisted all medicines: upon applying an electric shock the patient jumped up, ran into the hall, and asked for his discharge from

Disease.	Mode of Simulation.	Mode of Detection.
	other signs of disease; the countenance indicated health and intelligence; the function of the brain was undisturbed, and all the senses were entire. Paralysis of the arm is a complaint frequently feigned by soldiers, but it is very rare in reality. In true paralysis, the effects of palsy are seen in the muscles, and the temperature is lessened. In paraplegia the urine is altered. In ptosis the malingerer resists the raising of the eyelid.	the infirmary. During sleep, on irritating the affected limb, it will be drawn away in factitious cases. In lead palsy, we should expect to see the blue line along the gums. General rules for distinguishing between real and assumed disease ascribed to railway accidents are given at pp. 52–55.
40. Peritonitis.	Inflammation of the peritoneum is often feigned, especially perhaps by hysterical women. Great pain over the abdomen is complained of, the slightest pressure is said to give agony, and the patient excites herself until her skin becomes hot and pulse frequent.	Engage the patient in conversation—excite her attention, and then make pressure upon the abdomen: a simulator will feel no pain and utter no complaint. Examine pulse, expression of countenance, &c.
41. Phthisis.	Tubercular disease of the lungs would appear to be one of the least likely affections to be feigned, the peculiarity and complexity of the symptoms, and the wasting of the body, seeming to render hopeless any scheme of fraud. Yet phthisis has often been simulated, especially after recovery from other diseases, when pain, cough, and debility are readily assumed, and artificial hæmoptysis induced.	An acquaintance with the phenomena of the real disease, and a physical examination of the chest, will enable the physician to distinguish between true and false phthisis.
42. Pregnancy.	Pregnancy has been feigned to gratify the wishes of the husband or relations, or to extort money or compel marriage. On the authority of Madame de Créquy, it may be noticed, that after the first French revolution, a society was formed in Paris, the members of which imitated the costumes and manners of the ancient Greeks and Romans. At this time there was much talk of patriotism, and of the want of children for the republic. The ladies all aspired to the glory of producing citizens. Those who were *enceinte* made the greatest display of their condition, while those less fortunate invented a style of dress which should, at least, give them the reputation of being so. Occasionally a woman will deceive herself, and believe that she is pregnant without any just cause. We remember being summoned	Examination of the breasts, and of the uterus, per vaginam, will always detect the imposition. The breasts are fuller, there is a dark areola round the nipple, and often milk secreted. The uterus is perceptibly enlarged at the third month, the neck is soft, full, elongated; the lips of the os become indistinct and swollen; the orifice more or less circular. The uterus gradually enlarges, and presently ballottement is felt, and the fœtal heart can be heard.

	to a lady, said to be in labor. On arriving at the house we found everything prepared, the nurse in attendance, and the patient suffering from what she termed labor pains. Yet, on examination, it was proved that she was not even pregnant, and that the abdomen was merely enlarged from fat and flatus.	
43. Rape.	Rape is regarded as the forcible introduction of *any* part of the male organ into the vagina; there need not therefore be any marked injury. The presence of a vaginal discharge, with more or less swelling, in children or young persons out of health, might sometimes be regarded as evidence of local injury! This is by no means necessarily the case.	To detect rape, we should have to find spermatozoa in the vagina or clothes, the evidence of clear injury without discharge, which must be shown to be not self-inflicted, the presence of bruises, scratches, or other evidences of resistance. Absence or presence of the hymen goes for little, unless there be within three or four days swelling and increased heat and discharge of sero purulent fluid, and the fourchette, or hymen be actually torn. The man should also be examined, to see if he be competent, &c.
44. Rheumatism.	Rheumatism, gout, lumbago, and sciatica are often feigned by members of benefit societies, and others wanting to shirk work The sufferings are generally described as too acute, and the part is altogether overacted. It was probably in reference to gout that the poet Young sang, in his "Love of Fame:" "Polite diseases make some idiots vain, Which, if unfortunately well, they feign."	Attention to the constitutional symptoms, and noting their absence in factitious cases, will generally lead to a correct diagnosis. When there is real disease, there is disturbance of digestion, loss of appetite, often wasting of the muscles of the affected parts, febrile disturbance.
45. Stone.	Women feign stone in the bladder sometimes.	The non-detection of stone, and the contradictory nature of the symptoms, if the case be feigned.
46. Swelling of the Limbs.	Œdema of the legs has been produced by applying a ligature round the thighs.	Examine the limbs uncovered.
47. Shortsightedness.	This is an excuse for entering the army.	Hold a book, says Casper, about eight inches from the eye, and it cannot be read fluently by a myopic subject, or put before the suspected person glasses of from twelve to twenty inches focal distance, mingled with others of window glass, and observe his conduct.

DISEASE.	MODE OF SIMULATION.	MODE OF DETECTION.
48. Tumors.	See abdominal tumors, hernia, hydrocele, pregnancy, &c.	
49. Ulcers.	Ulceration has often been produced by cantharides, lime, and other irritants. They have also been simulated by gluing a piece of spleen on the part.	Such ulcers are readily healed; their edges are not callous.
50. Urine—Foreign Bodies in.	This has always been a favorite source of deception. The fruit of the Indian fig colors the urine as red as blood. Cantharides will render it scanty, high-colored, and of high specific gravity. Milk, sand, fatty matters, &c., are often mixed with this secretion. The excretion of gravel is often feigned.	The microscope will discover most impositions, as when sand, starch, milk, and flour have been added. In milk, we find oil-globules; in chylous urine there is fatty matter in a molecular state, but not a single oil-globule. The patient should be made to pass his urine in the presence of the surgeon

CHAPTER VII.

ON THE PHYSICAL DIAGNOSIS OF DISEASE.

THE existence of disease involves the presence of physical or anatomical change, sometimes confined to the part originally affected, but often extending to the adjoining structures. "The anatomical changes thus arising," says Dr. Walshe, "may or may not be capable of accurate discrimination during life. When they can be so discriminated, experience has shown that their detection is not so much accomplished by means of the vital functional derangements of the organs implicated, as by the aid of various alterations in the physical properties of those organs—as, for example, their density, their faculty of generating and of conducting sound, &c. So invariably do these alterations bear a certain and fixed relation to the physical nature of the anatomical conditions with which they are associated, that the discovery of the former is conclusive as to the existence of the latter. And not only the physical nature, but the precise limits and the precise degree of these conditions are disclosed by the alterations referred to, which, for these reasons, constitute their *physical signs.* Interpreted by the observer, and not by the patient,—incapable, except in the rarest instances, of being feigned, dissembled, or even modified at will,—estimable in degree and extent with almost mathematical precision, susceptible of indefinite refinement,—physical signs, like the whole class of objective phenomena of disease, are of immeasurably greater diagnostic, greater general clinical value than its subjective symptoms. Physical signs are, in fact, the true indices of the physical nature, extent, and degree of textural changes, and may be regarded as instruments of pursuing morbid anatomy on the living body. But just as their significance is sure and precise, so is the difficulty of mastering their theory and practice positive and great; and hence it is that physical diagnosis has gradually acquired for itself the importance of a special art."[1]

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[1] "A Practical Treatise on Diseases of the Lungs and Heart." Second edition, p. 2.

SECTION I.

THE PHYSICAL DIAGNOSIS OF CEREBRAL DISEASES.

A few years since Dr. John Fisher and Dr. Whitney, of the United States, published some observations on Cerebral Auscultation,[1] but this method of observation in cerebral diseases has fallen into disuse, as it has not been found of very practical value. It is therefore needless to enter into any detail on this point.

SECTION II.

THE PHYSICAL DIAGNOSIS OF DISEASES OF THE LUNGS AND HEART.

Introductory Remarks on the Structure of the Lungs.—The lungs—the organs of respiration—are contained in the cavity of the thorax, one on either side of the spine. They are irregular conoid bodies, the bases of which rest upon the diaphragm, while the apices project upwards, extending somewhat above the level of the clavicles. Between the fourth and fifth ribs, near the left edge of the sternum, a small oval-shaped space is left between the two lungs, where part of the pericardium remains uncovered, the remainder of the pericardium and heart being received into a depression in the inner surface of the left lung. The right lung, somewhat broader but shorter than the left, owing to the position of the liver, is divided into three lobes ; the left into two. It is supposed that the structure of the lungs is fully known to the reader.

Position of the Patient.—In the investigation of pulmonary or cardiac affections some care is necessary to place the patient in such a position that the parietes of the chest may be rendered firm and tense without affecting his ease or comfort, and without being inconvenient to the examiner. When the forepart of the chest is to be examined, and the patient is able to sit up, the best position of all will be sitting upon a chair, in the middle of the room, opposite to a good light, with the arms hanging loosely down by the sides, the head thrown back, and the upper part of the body uncovered. To examine either lateral region, place the patient's hand of the side to be examined upon the back of his head, and make him lean a little to the opposite side. To percuss or auscultate the back, let him lean well forwards, hold down his head, and fold his arms across the breast.

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[1] "American Journal of Medical Science," vol. xxii, p. 277, and vol. xxxii, p. 283.

The chest may also be very carefully explored while the sufferer sits up, or even while lying down in bed, being turned to either side as may be necessary, and as far as his strength will admit. The surrounding bed-curtains and furniture have little or no effect in deadening the sound educed by percussion, although some practitioners have thought otherwise. It is of importance, however, that the room in which the examination is being made should be as quiet as possible, and the examiner should also take care that no part of his own or the patient's dress rubs against the stethoscope.

Regions of the Thorax.—Before proceeding to the consideration of the various methods of physical diagnosis, it is necessary to notice that the surface of the chest has been artificially mapped out into regions, for the purpose of localizing the physical signs as accurately as possible. In dividing the thorax into regions, different observers adopt different boundaries. The plan proposed by Dr. Sibson is certainly the most philosophical; but the following arrangement has the merit of simplicity, and is that most frequently followed:

Regions.	*Sub-Regions.*
a. Anterior.	1. The two clavicular.
	2. The two subclavian.
	3. The two mammary.
	4. The two infra-mammary.
	5, 6. The sternal: 5. The upper sternal. 6. The lower sternal.
b. Lateral.	7. The two axillary.
	8. The two lateral, or sub-axillary.
	9. The two lower lateral.
c. Posterior.	10. The two acromial.
	11. The two scapular.
	12. The two inter-scapular.
	13. The two dorsal.

The *first sub-region—the clavicular*—one on each side, corresponds in outline with that portion of the clavicle behind which the apices of the lungs lie, being nearly the inner half of the bone. On percussion the sound should be very clear, the resonance diminishing from the sternal to the acromial end of the clavicle, until it becomes quite dull in the latter part.

The *second sub-region—the subclavian*—comprises that part of the thorax between the clavicle and upper part of the fourth rib, bounded outside by the deltoid, inside by the edge of the sternum; beneath it lie the upper lobe of the lung, and towards the sternum the main bronchial tube. On the right side also, close to the sternum, lie the superior vena cava, and a portion of the arch of the aorta; whilst to the left is the edge of the pulmonary artery. The resonance afforded by percussion should be very clear.

A little lower down is the *third or mammary sub-region*, extending from the fourth to the seventh rib on each side, bounded externally by a line drawn vertically about an inch and a half external to the nipple, and internally by the sternum. On the right side the lung lies throughout immediately under the surface, the sound educed by percussion being clear, except at the lower part, where the right wing of the diaphragm and the liver begin to mount; on the left side we find the heart, partly uncovered by lung at the lower part of this region, and consequently there is some degree of dulness.

The *fourth, or infra-mammary sub-region*, is bounded above by the seventh rib, below by the edges of the cartilages of the false ribs, externally by a continuation of the line of the mammary region, and internally by the margin of the lower fourth of the sternum. On the right side the liver—covered at its upper part by the thin margin of the lower lobe of the lung—occupies this region; while on the left is found the stomach, the anterior edge of the spleen, and generally towards its inner part a small portion of the left lobe of the liver. The sound elicited by percussion will be dull, unless the stomach be tympanitic, when it will be preternaturally resonant.

The *fifth and sixth sub-regions, or the upper and lower sternal*, comprise the sternum, and are the only single regions. In the *upper sternal portion*, corresponding to that part of the sternum above the lower border of the third rib, are found the left vena innominata; the ascending portion of the arch of the aorta; the aortic valves—near the lower border of the third left cartilage, and a little higher and just at the left edge of the sternum, the pulmonary; and the trachea with its bifurcation—on the level of the second ribs; the inner edges of the lungs almost unite over these parts down the centre of the region. The sound on percussion should be moderately clear. The respiratory murmur is heard mixed with true bronchial breathing, and there will be resonance of voice. In the *lower sternal portion*, corresponding to the remainder of the sternum, is the right ventricle: and inferiorly a part of the liver, and often of the stomach; the tricuspid and mitral valves lie opposite the upper edge of this region at mid-sternum.

The *eighth sub-region, the axillary*, consists of the axilla, above the fourth rib, on each side. The *ninth, or lateral*, is just below, between the fourth and seventh ribs; while still lower is the *tenth, or lower lateral.* In the first two the percussion-sound is clear; in the last it is dull on the right side, owing to the position of the liver, and often tympanitic on the left over the stomach.

The posterior region includes the *acromial sub-region*, which affords but little information on percussion, the sound being dull; the *scapular sub-region*, corresponding to the middle lobes of the lungs, but which gives a dull sound, owing to the thickness of the bones and their muscles; the *inter-scapular*, occupying the space between the inner edge of the scapula and the spines of the dorsal vertebræ from the second to the sixth, and being resonant on percussion; and lastly, the *thirteenth, or dorsal sub-region*, answering to the base of the lung, and giving at its upper part a clear sound; but at its lower, on the right side, a dull one, owing to the position of the liver; and a tympanitic one on the left, owing to the position of the stomach.

Another mode of dividing the chest into regions, with which the reader should be acquainted, has been proposed by Dr. Sibson, who defines the outlines of the regions by the anatomical boundaries of the subjacent organs. These regions consists of—1. The simple: including the right pulmonic, the left pulmonic, the cardiac; and 2. The compound; including the pulmo-hepatic, the pulmo-gastric, the right pulmo-cardiac, the left pulmo-cardiac, the pulmo-vasal.

Of the simple regions, *the right pulmonic* is bounded above by the apex of the right lung; below, by an imaginary line drawn through the right convexity of the diaphragm or the fifth intercostal space in front, and the articulation of the eighth rib behind; and internally, by a line drawn down the centre of the sternum. *The left pulmonic* has the apex of the left lung above; an imaginary line resting upon the left convexity of the diaphragm —which is an inch lower than on the right side, below; and internally the imaginary line drawn down the centre of the sternum, except between the lower margin of the fourth and the upper part of the seventh ribs, where the lung forms a curve externally, leaving the pericardium uncovered. The *cardiac region* corresponds to the heart.

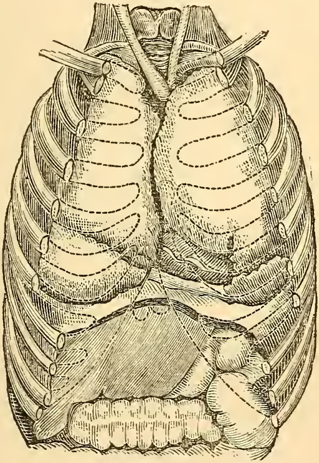
Of the compound regions, *the pulmo-hepatic* is over that layer of lung which caps the upper portion of the liver on the right side; *the pulmo-gastric*, over that covering a part of the liver, stomach, and spleen; *the pulmo-cardiac* —right and left—corresponds to the portions of the lungs overlapping the right and left sides of the heart; while *the pulmo-vasal* corresponds to the layer of lung between the sternum and great vessels, extending upwards along the sternum from the third sterno-costal articulations.

These are somewhat difficult details for the student to remember, and we may therefore sum up the general position of the organs within the chest as follows:

General Position of the Organs in the Chest.—The apices of the lungs reach from one to one and a half inches above the first rib, that of the right lung being perhaps slightly the higher. Externally, the lung above is bounded by a line drawn from an inch outside the centre of the clavicle to the centre of the corresponding axilla; on the inside, by a line running from the extreme apex to the inner point of the first interspace, where the two lungs meet. The edge of the right lung now descends slightly to the left of the middle line of the sternum and to the base of the latter. The pleura of the right lung is consequently attached to the left of the mid-sternal line. The left lung leaves its fellow and the sternum at the fourth left cartilage, and its edge runs outwards and downwards to just inside the nipple (left), when it again passes inwards. The lower boundaries of the lungs are as follows: that of the right lung is indicated by a line drawn from the base of the sternum across the cartilage of the sixth rib, and the end of the seventh to the ninth or tenth rib near the spine behind. The left lung is a little lower. It is important to know that the height of the diaphragm varies in the two sides, rising to the level of the fifth rib on the right and the sixth rib on the left; all this will be seen in

Fig. 4. The relative position of parts is altered during inspiration; the bases of the lungs descend one or one and a half inches lower than is the case during expiration. The relative position of the heart and the lungs in the condition of health is as follows: the right lung covers the right auricle and a bit of the right ventricle, the upper part of the right ventricle being covered by the left lung. The lower part of the right ventricle is uncovered by lung, and comes forward to the chest-wall; it lies under the sternum and cartilages, below the fourth. The left auricle is covered by the right auricle and the left lung. The left ventricle lies mostly away from the surface, its upper edge is covered by the left lung, but its apex comes forward to the surface below, and "beats" between the fifth and sixth ribs, an inch or perhaps less to the inside, and one and a half inches below the left nipple. It will be seen that there is a small space commencing above where the left lung leaves its fellow, at the fourth cartilage, in which the heart is uncovered. The relative position of

Fig. 4.

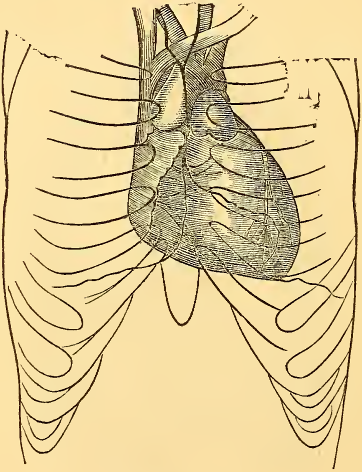


(After Sibson.)

the heart and lungs around is well seen in the accompanying diagram. Fig. 5. It is supposed that the heart is seen through the lungs, the dark line at mid-sternum branching outwards right and left below, representing the edge of the lungs. (See also p. 228 et seq.)

Description of the Methods of Physical Diagnosis. —The various means by which the physical signs of pulmonary and cardiac affections are elicited, are termed methods of physical diagnosis, and these methods consist of—

Fig. 5.



(After Sibson.)

1. Inspection.
2. Palpation, or the application of the hand.
3. Mensuration.
4. Succussion.
5. Spirometry.
6. Percussion.
7. Auscultation.

The general mode of practising these methods, and the signs to be deduced from the examinations, have now to be described and considered.

1. INSPECTION.

By inspection or ocular examination of the external surface of the chest, we learn the general form of the framework, the shape of the sternum and rib cartilages, the size of the cavity, and the movements of its walls. The patient should be placed in an easy, comfortable position; sitting, if possible, opposite a good light, and with the surface of the chest exposed. Inspection should be practised anteriorly, posteriorly, and laterally, and the action of the two sides of the chest should be closely compared; since pulmonary diseases are in the majority of cases limited to one side, and impede proportionally the costal movements of one-half of the chest only.

Form.—Regularly formed chests, presenting to the eye a cone, having its narrow end uppermost, its two sides symmetrical, and its transverse diameter exceeding the antero-posterior, are much more rarely found than is commonly supposed, certain marked deviations of form, which are quite compatible with a perfect state of local and general health, being very common. One side of the chest may be larger than the other, as the result of special occupations that call into play the muscles of one particular side or of one arm constantly. It need hardly be mentioned that the practitioner must be on his guard not to confound the natural alterations of shape, with those dependent upon disease; an error which he can scarcely commit, provided attention be paid to all the circumstances of the case. In health the right side is usually about half an inch larger than the left. The chest may be altered on both sides by any cause that compresses its walls, as by tight stays, or that leads to disease in both lungs, as in emphysema of both sides, when the chest is barrel-shaped, or in phthisis, when flattening of one or both subclavicular regions occurs. Shoemakers are peculiarly flat-chested; this arises from the position in which they work. Undue prominence of one side of the chest is best seen in cases of abundant pleuritic effusion, in pneumothorax, hydrothorax, effusion of blood into the pleuræ, effusion of fluid into the pericardium, and general vesicular emphysema; less distinctly in hypertrophy of the lung, and during the growth of intrathoracic tumors. Local bulging is found in pleuro-pneumonia, emphysema, intrathoracic tumor, and enlarged liver or spleen. Again, in cases of pleurisy with abundant effusion, the diseased side often measures an inch or even two inches more than the other; the ribs and cartilages assume the position which they present during a deep inspiration; the intercostal spaces are pushed outwards, and in them fluctuation may occasionally be distinguished. In pericardial effusion, and in hypertrophy of the heart, the bulging will be found in the mammary and lower sternal regions; while in aneurism of the aorta it will be noticed in the upper and central parts of the chest.

Retraction—a sinking of the framework of the chest on one side, and depression—a sinking of only one spot or sub-region, are the opposite states to undue prominence and bulging. Retraction cannot be present without reduction in size of the lung, which may be produced either by extrinsic pressure or by changes in its own substance. Now, retraction is one of the most common results of pleurisy, when the effused fluid has been partially or entirely absorbed; for the lung having been compressed against the vertebral column, deprived of its elasticity, and frequently bound down by the formation of false membranes, is prevented from re-expanding and resuming its original volume as the fluid is removed; so that in order to obviate that void which would otherwise exist between the ribs and the lung, the former sink in and approach the latter. The retraction will also appear the greater from the sound lung becoming hypertrophied, owing to its having to perform double work. The lung is also reduced in volume, causing retraction and depression in tubercular disease, in collapse, in pneumonia during the stage of resolution, in cirrhosis, and in cases where its functions are interfered with by the pressure of tumors, as in cancer, or aneurisms, or enlarged glands. When alteration in the shape of the side occurs, the heart will often be displaced. In healthy persons, the heart's impulse is generally visible only at the apex, which beats in the space between the left fifth and sixth ribs, about midway between the nipple and left border of the sternum. In cases of pericardial effusion, or of hypertrophy of the heart, the cardiac region becomes arched forwards, the intercostal spaces widen, and the left border of the sternum is pushed more or less forwards; the apex-beat of the heart is also raised in the case of pericardial effusion, while in hypertrophy it is depressed, sometimes being carried as low as the space between the seventh and eighth ribs, or even slightly lower. If both sides of the heart be equally hypertrophied, the apex point will be displaced to the left; if the left cavities alone, to the left—even to as great an extent as three or four inches from its natural spot; while if the right cavities suffer mainly, the impulse will be to the right—towards or even beneath the sternum. When there is retraction of the side, the heart falls over to the diseased side, being in many cases pushed over by the enlarged and hypertrophied lung of the unaffected side; the apex-beat may be found a long way to the right or left of its normal site, according to the lung affected; the heart's apex is always carried over *to* the retracted side.

Size.—The variations in size between the two sides of the thorax, occurring in consequence of disease, are more readily appreciated by measurement than by inspection, and hence will be treated of in the section on Mensuration. It may be well to repeat, however, that in most persons the right side of the chest is naturally half an inch larger than the left.

Movements.—The motions of the chest-walls may be increased or diminished. In spasmodic asthma and pneumonia the movements of both sides of the chest are much increased during the attack, and such also is the case in many instances of croup, laryngitis, and laryngeal obstructions, hysteria, and similar affections. There is a want of due expansion of the affected side in paralysis, and in great debility of the respiratory muscles; in pleurodynia, the early stage of pleurisy, and rheumatism or neuralgia of the intercostal muscles, when each respiration causes acute pain, the movement is lessened on the affected side. The chest-walls also expand less than in health in obstruction to the functions of the lung from disease—as in advanced phthisis, in pulmonary consolidation from pneumonia or other causes, in pneumothorax, hydrothorax, and obstruction of the main bronchial tube; and lastly, in disease of the heart, in aneurismal tumors, and in enlargement of the liver, impeding respiration on the right side.

2. PALPATION, OR THE APPLICATION OF THE HAND.

Palpation is employed in the same way and for the same purposes as in other regions of the body, to ascertain the condition of the integuments as to temperature the degree of nutrition, the presence of local tenderness, muscular pain, and the like. Palpation is useful in distinguishing the nature of a painful affection, such as muscular pains, since slight pressure often evokes such pain, while gradual and firm pressure is unattended by it. The apex-beat of the heart is ascertained by the fingers, so likewise are abnormal pulsations in the intercostal or supra-sternal and other regions.

By placing the palms of the hands upon both sides of the chest, gently and evenly, and with such a moderate degree of pressure as to enable them to participate in—but not to deaden—the vibrations, we can appreciate the excess or defect of motion in the two sides, and thus compare the results.

Palpation—below the clavicles in the female, and below the epigastrium in the male—is the best mode of learning the number and force of the respirations.

Vocal Vibration, or Fremitus.—On applying the hand to the chest of a healthy individual while he is speaking, a slight thrilling sensation will be communicated to the fingers, more marked in adults than in children, in males than females, in short-chested than long-chested persons, and in the spare and thin than in the stout; it is also most distinct over the larynx and trachea, and generally better appreciated on the right side than the left. The act of coughing produces a similar but less marked vibration. The natural vocal fremitus or thrill may be increased or diminished by disease. It is *augmented* when the density of the pulmonary structure is increased—as in congestion of the lung, in pneumonia, and in tubercular infiltration; it is *diminished* or *annulled* when anything interferes with the transmission of the vibrations through or from the lung, as is the case when a layer of fluid is present between the chest-wall and the lung, as in pleuritic effusion.

Pulmonary Friction-fremitus.—The gliding motion of the costal upon the pulmonary pleura gives rise to no vibration in health; but in many cases of pleurisy, when their surfaces become roughened, a distinct cracking sensation or rubbing movement—friction-fremitus—is conveyed to the hands.

Fluctuation.—Palpation will sometimes detect the presence of fluids contained in the lungs or pleuræ, the sensation communicated being that of ordinary fluctuation, with a certain amount of vibratile tremor.

The Heart's Impulse.—Synchronous with the systole of the ventricles and the first sound of the heart an impulsive movement is felt, depending on the shock of the apex against the side: the force of the impulse being, to a certain extent, proportionate to the healthy condition of the muscular fibres of the heart's walls. In health the apex-beat is felt between the fifth and sixth ribs on the left side, an inch and a half below and an inch to the inner side of the left nipple. There is no sign of hypertrophy of the heart so sure as that afforded by great increase of its impulse. The impulse is weakened in all lowering diseases, by certain narcotics—aconite, belladonna—emphysema, hypertrophy of lungs, pericardial effusion, dilatation of the heart, fatty disease of the heart, &c. It is exaggerated in consolidation of the overlapping lung, by solid substances in the mediastinum or pleura, by the enlargement upwards of the liver or spleen, by atrophy of the lungs, by falling in of the chest-wall, in chlorosis, functional excitement of the heart, by cardiac inflammation and valvular changes, and in hypertrophy with pericardial adhesions.

The inordinate action of the heart, as well as the extent and degree of pulsations, will be ascertained by palpation.

Frémissement Cataire.—Of all the irregular vibrations of the thoracic walls, the most important is the valvular thrill, or purring tremor, or *frémissement cataire* of Laennec, resembling—it is said—the sensation afforded by stroking the back of a purring cat. This phenomenon, called also *cardiac thrill*, is always accompanied by a bellows-murmur, and occurs in those conditions of the heart—organic or inorganic—which yield this murmur with the greatest intensity; thus it is very distinct in mitral regurgitant disease, with dilated hypertrophy of the left ventricle, in constrictive aortic disease, with hypertrophy of the ventricle, and in chlorosis—in the latter case proving a good index of the condition of the blood, since it becomes less distinct as the quality of the vital fluid improves.

Cardiac Friction-fremitus.—In inflammation of the pericardium a friction-fremitus may sometimes be felt. When discovered, it will always be found to be of short duration, and generally movable. It is often best felt in the absorption period of the disease.

3. MENSURATION.

In applying mensuration a common tape-measure is often sufficient, though the double tapes, as suggested by Dr. Hare, may be advantageously used, or—where great exactness is necessary—Dr. Sibson's chest-measurer, or Dr. Quain's stethometer (see Chapter II, Section 4) may be found necessary. The object of measuring the chest is to ascertain more exactly than can be done by inspection and palpation the comparative bulk and volume of the two sides, as well as the amount of expansion and retraction of the chest-walls during inspiration and expiration.

The circular width of the chest—taken opposite the ensiform cartilage—varies considerably in healthy individuals; it increases gradually with age, from sixteen to sixty, and is greatest in persons whose occupations demand active exertions of the whole frame; probably thirty-four or five inches may be regarded as the fairest adult average. The two sides of the chest are of unequal semi-circumference in the great majority of healthy adults, the right side measuring about half an inch more than the left; in left-handed people, the two sides are generally equal.

The diseases which cause enlargement of the affected side of the chest are pleurisy with effusion, pneumothorax, hydrothorax, emphysema, hypertrophy of the lung, and cancerous tumors of the lung or pleura; while the converse obtains in pleurisy at the period of absorption with retraction, pleuro-pneumonia, tubercular deposit in the second stage, chronic consolidation of the lung, and infiltrated cancer of the lung.

From a large number of observations made by Dr. Sibson, with his "chest-measurer," he has established the following propositions concerning the respiratory movements in health. Thus, in the healthy robust male the forward movement of the sternum, and of the ribs—from the first to the seventh—ranges from one-fiftieth to one-fourteenth of an inch during an ordinary inspiration; and from half an inch or nearly two-thirds of an inch to two inches—the amount varying with the extreme breathing capacity—during a deep inspiration. Of the five lower ribs the ordinary movement is less, and the forced movement greater, than of the upper seventh. The ordinary abdominal movement is from a quarter to one-third of an inch; the extreme from about half an inch to an inch and a half. The ordinary lateral expansion of the five lower ribs is greater, and the extreme expansion is usually less, than the respective ordinary and extreme expansion of the seven upper ribs. The expansion of the second ribs is usually alike on both sides; below these all the inspiratory movements, especially those over the heart, are usually somewhat less on the left side than on the right, both during ordinary and extreme inspiration. In the healthy boy, owing to the greater flexibility of the costal cartilages, the motion of the sternum is less than that of the ribs, but the extreme movement of the seven superior ribs is greater in proportion to the breathing capacity than it is in the adult; the upper portion of the sternum advances more than the lower end during a deep inspiration, but there is little decided difference during tranquil respiration. In the old man, owing to the consolidation of the cartilages, the motion of the sternum during inspiration is usually greater than that of the ribs, and the lower end of this bone usually advances more than the upper. In females, the expansion of the seven superior ribs is exaggerated, and that of the diaphragm and lower ribs restrained, owing—in a great measure—to the use of tight stays. The restraining movement of the lower ribs during a deep inspiration is much greater when the stays are on than when they are off.

In those cases of disease in which there is great obstruction to the entrance of air through the outer air-passages during inspiration, as in cases of extreme narrowing of the larynx or trachea, or obstruction of a large bronchus, the walls of the chest actually fall backwards, to a greater or less extent, in proportion to the obstruction, instead of advancing during inspiration. The explanation of this phenomenon given by Dr. Sibson is, that the diaphragm acts with great power and lengthens the lung, and as air can only rush into the lengthened lung with great difficulty through the larynx, the lungs collapse, just as a half-filled bladder collapses when it is lengthened, and the presence of the atmosphere forces backwards the anterior walls of the chest.

In emphysema and bronchitis, in those cases where there is an obstruction to the entrance of air into the air-cells through the smaller air-tubes, the lower end of the sternum and the adjoining cartilages fall backwards during inspiration, while the upper part of the chest expands, and the diaphragm descends with great power. In pleurisy with effusion, the inspiratory expansion of the whole of the affected side of the chest is diminished, abolished, or in some cases even reversed; while that of the opposite side is throughout exaggerated: the inspiratory motion of the abdomen is also lessened or abolished on the affected side, while on the opposite side it is increased. When the whole of the lung is consolidated, from gray hepatization or tubercular deposit, or condensed from firm membranous bands following pleurisy, then the expansion of the whole of the affected side is diminished, arrested, or reversed, while that of the healthy side is exaggerated. So, also, when the upper lobe of the lung is affected with phthisis, pneumonia, or any local disease, or when the five superior ribs are injured, or when the intercostal muscles moving them are inflamed or affected with pleurodynia, or when the motion of these ribs produces pain in the arm or shoulder-joint, then the inspiratory motion of the five superior affected ribs is diminished, while that of the ribs of the opposite side is usually increased. When the lower lobe of the lung is the seat of pneumonia or any other disease, the motion of the ribs over that lobe is usually, but not always, diminished; and the motion of the abdomen just below the ribs, on the affected side, is always lessened.

When the heart is enlarged, and still more when the two surfaces of the pericardium are adherent, there is diminished motion of all the ribs on the left side, with the exception usually of the second and third. If there be pericarditis, the motion is still more interfered with, and the motion of the abdomen just below the xiphoid cartilarge is also much affected being in all cases lessened, and in extreme examples quite interrupted; the motion of the abdominal walls on either side is usually not affected.

In peritonitis, if the disease be general, the abdominal motion is universally diminished; if it be partial, the diminution of respiratory motion is most marked over the immediate seat of the inflammation.[1]

From the foregoing, it is apparent that the modifications of the respiratory movements in disease are of great value in aiding diagnosis, since, although the nature of the disease is not indicated by them, yet its seat is at once pointed out. In the majority of cases, the indications afforded by the senses of touch and vision will be sufficient; but, in obscure examples of pulmonary disease, the observations will be rendered more minute and accurate by the aid of the chest-measurer.

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[1] Dr. Sibson, "On the Movements of Respiration in Disease:" "Medico-Chirurgical Trans.," vol. xxxi, p. 376; and "Prov. Med. and Surg. Journal," Sept. 5th, 1849.

4. SUCCUSSION.

Succussion is performed by gently but abruptly pushing the patient's trunk backwards and forwards, or, by the patient himself making the same movement, while the observer's ear is applied to the walls of the thorax. It is employed to detect the sound of thoracic fluctuation, produced by the violent collision of air and liquid in a cavity of somewhat large dimensions, and compared by Dr. Walshe to the splashing of water in a partly-filled decanter held close to the ear; the precise tone, however, will vary with the density of the fluid, and the proportion of fluid and air present. The sound of thoracic fluctuation may also be accompanied with metallic tinkling. It is elicited in cases of pneumo-hydrothorax, with pulmonary fistula; or, very rarely, pneumo-hydrothorax, when no fistulous communication exists between the lung and pleura; and in phthisis, when the tubercular cavity is large and partially filled with fluid.

5. SPIROMETRY.

The spirometer is an instrument for measuring the volume of air expired from the lungs, the construction of which, as well as the way in which it is to be used, is fully explained in Chapter II, Section 3.

The extent of the movements performed by the thoracic boundaries for the purposes of respiration, admits of three degrees of modification:

a. Extreme expansion (inspiration).
b. Extreme contraction (expiration).
c. Intermediate condition (ordinary breathing).

The first two movements displace a larger, and the third movement a smaller volume of air. The spirometer measures collectively these three volumes of air—that is to say, the most complete voluntary expiration immediately following the most complete inspiration, or the quantity of air which a man can expel from his lungs by the greatest voluntary expiration after the greatest voluntary inspiration, which Dr. Hutchinson denominates the "vital capacity," or the "vital volume."[1] The vital capacity volume is the limit of all the requirements for air which man can require; the ordinary breathing is a quiet, gentle, and more limited movement. The ordinary breathing movement may be considered, then, to have "a spare margin which is ever at command—a margin absolutely necessary to health. When we cannot command this margin—*i. e.*, extend the ordinary breathing movement into the extraordinary breathing movement—the body is incommoded, and our well-being suffers relative to the degree of change in the thoracic mobility." The spirometer not only measures this margin together with the ordinary breathing movement, but it also determines the permeability of the lungs to air. Dr. Hutchinson chose to found his observations upon the vital capacity volume rather than upon the ordinary breathing volume, because the former is from twelve to twenty times greater than the latter, and an error of a few cubic inches in the larger volume is of little consequence; while an error of a few cubic inches in the ordinary breathing volume is of such importance as to disguise the correct measurement of the natural breathing volume, and is sure to occur from the nervousness or stupidity of the person examined.

The vital capacity volume is affected by height, by attitude, by weight, by age, and by disease.

The Vital Capacity as affected by Height.—From a very large number of experiments, Dr. Hutchinson has deduced the curious fact that the height of an individual is the chief condition which regulates his vital capacity, and he lays down the following rule: That in the erect position, for every inch of stature from five to six feet, eight additional cubic inches of air, 60° Fahr., are given out in one volume, by the deepest expiration, immediately following the deepest inspiration. This table is intended to show the capacity in health and in the three stages of phthisis.

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[1] "Medico-Chirurgical Transactions," vol. xxix, p. 138.

Height.				Capacity in Health.	Capacity in Phthisis pulmonalis.		
Ft.	in.	Ft.	in.	Cub. in.	1st Stage. Cub. in.	2d Stage. Cub. in.	3d Stage. Cub. in.
5	0 to	5	1	174	117	99	82
5	1 "	5	2	182	122	102	86
5	2 "	5	3	190	127	108	89
5	3 "	5	4	198	133	113	93
5	4 "	5	5	206	138	117	97
5	5 "	5	6	214	143	122	100
5	6 "	5	7	222	149	127	104
5	7 "	5	8	230	154	131	108
5	8 "	5	9	238	159	136	112
5	9 "	5	10	246	165	140	116
5	10 "	5	11	254	170	145	119
5	11 "	6	0	262	176	149	123

This reads thus : A man between 5 ft. 7 in. and 5 ft. 8 in. in height, should be able to breathe, in health, 230 cubic inches ; in the first stage of consumption this will be reduced to 154 ; in the second to 131 ; and in the third to 108 cubic inches. A knowledge of these facts on the part of the practitioner is of importance in reference to the examinations of persons assuring their lives, in guiding him in doubtful cases.

Weight as affecting the Vital Capacity.—In examining diseases of the lungs, the indications afforded by the weight of the individual are invaluable. One of the first signs of disease, generally, is loss of weight ; a steady loss always precedes consumption, and is the earliest symptom of tubercular disease. Dr. Hutchinson has observed, that a slow and gradual loss is more serious than a rapid and irregular diminution. A person may lose weight, but he cannot do this gradually without some severe exciting cause.

Weight in excess begins mechanically to diminish the breathing movements when it has increased to 7 per cent. beyond the mean weight ; and from this point the vital capacity decreases 1 cubic inch per lb. for the next 35 lbs. The ordinary weight increases with the height, probably about 6½ lbs. per inch of stature. It is unnecessary, however, to make the correction for weight, unless it be much in excess. From an examination of 2650 healthy men at the middle period of life, Dr. Hutchinson has deduced the following table :

Exact Stature.		Mean Weight.			Weight increased by 7 per cent.		
Ft.	in.	St.	lbs.	lbs.	St.	lbs.	lbs.
5	1	8	8	or 120	9	2	or 128
5	2	9	0	" 126	9	9	" 135
5	3	9	7	" 133	10	2	" 142
5	4	9	13	" 139	10	9	" 149
5	5	10	2	" 142	10	12	" 152
5	6	10	5	" 145	11	1	" 155
5	7	10	8	" 148	11	4	" 158
5	8	11	1	" 155	11	12	" 166
5	9	11	8	" 162	12	5	" 173
5	10	12	1	" 169	12	13	" 181
5	11	12	6	" 174	13	4	" 186
6	0	12	10	" 178	13	8	" 190

This table reads: A man of 5 ft. 8 in. should weigh 11 st. 1 lb., or 155 lbs. (14 lbs. = 1 stone); he may exceed this by 7 per cent., and so attain 11 st. 12 lbs., or 166 lbs., without affecting his vital capacity; beyond this weight his respiration becomes diminished.

Age as affecting the Vital Capacity.—The vital capacity is found to be at a maximum between the ages of thirty and thirty-five, though the effect of age is not very manifest, *until a person has attained fifty-five years, when the capacity diminishes sufficiently to render it necessary to make a subtraction.* This we must do according to the annexed table:

Height.						Mean.		Minimum.
Ft.	in.		Ft.	in.	Age. 15 to 55.	Age. 55 to 65.	Age. 65 to 75.	16 per cent. below mean.
5	0	to	5	1	174	163	161	146
5	1	"	5	2	182	173	168	153
5	2	"	5	3	190	181	175	160
5	3	"	5	4	198	168	182	166
5	4	"	6	5	206	196	190	173
5	5	"	5	6	214	203	197	180
5	6	"	5	7	222	211	204	187
5	7	"	5	8	230	219	212	193
5	8	"	5	9	238	226	219	200
5	9	"	5	10	246	234	226	207
5	10	"	5	11	254	242	234	213
5	11	"	6	0	262	249	241	220

Thus it appears that a man of 5 ft. 8 in., of the mean weight, may be expected to breathe 230 cubic inches until the age of fifty-five, 219 cubic inches from fifty-five to sixty-five, and 212 from sixty-five to seventy-five years of age. The vital capacity is somewhat reduced by a moderate meal, and by a full meal 9 to 14 inches.

In all the foregoing calculations, it is supposed that the patients are dressed in ordinary attire. We therefore have to make no allowance for boot-heels, weight of dress, &c. It may be remarked, however, that M. Quetelet estimates the average weight of the clothes, at different ages, as one-eighteenth of the total weight of the male body, and one-twenty-fourth of the total weight of the female. The value of spirometry in life assurance, in the detection of lung disease, is very great.

6. PERCUSSION.

Percussion—the act of striking the parietes of the cavities of the body in such a manner as to enable the examiner to judge of the density of the subjacent parts—is one of the most important means of physical diagnosis in diseases of the chest. It is said to be *immediate* or *direct* when nothing intervenes between the percussing agent and the part percussed; *mediate* when some solid substance—as the finger or a plate of ivory—is placed upon the part to be explored, and the blow made upon such substance. In the present day mediate percussion is generally employed; the fore or middle finger of the left hand, pressed firmly against the chest, serving as a *pleximeter*, while the ends of those of the right hand, brought together into a line, form the *plessor* or *percussor*. Immediate percussion may be performed by striking the chest with the palmar surface of the fingers. In practising percussion, it is best to strike first on one side of the chest and then on the corresponding spot of the other side, in order to compare the results; since our estimate of the presence or amount of disease is determined more by the relative degree of dulness or resonance on the opposite sides, than by any absolute degree of dulness: in doubtful cases the observation should be repeated many times, and in various postures. The strokes also should be made quickly, smartly, and uniformly, and at right angles to the part percussed; and the hand should be moved from the wrist alone, the fore-arm and arm being held motionless, as the strokes will be better regulated, and fall more uniformly on the parts struck.

In percussion, if the chest be struck over a portion of healthy lung, a hollow or clear sound will be produced: if over a portion of lung which has lost its spongy character, and is void of air, or in any way solidified, either by pressure from without—as in pleuritic effusion, or by deposit within—as in pneumonia or pulmonary apoplexy, then only a dull, heavy, or dead sound will be heard; so also when that part of the parietes covering the heart—the lower sternal region and that portion of the left mammary which is covered by the cartilages of the fifth, sixth, and seventh ribs—is similarly struck, the resulting sound will be dull; and if the heart be enlarged, or its investing membrane filled with fluid, or its chief vessels enlarged by aneurism, the extent of dulness will be increased in proportion to the extent of the disease. The lungs yield their normal, full, clear sound, slightly more and more distinctly from above downwards, owing to their increasing capacity; the sound being muffled, however, by the pectoral muscles, the mammæ, and the scapulæ. On the right side, from the sixth rib, a dead sound is produced from the presence of the liver; the same is elicited on the left, from the junction of the fourth costal cartilage with the left border of the sternum, to the point where the heart's impulse is felt, owing to the position of the heart; while below on this side, to the left, at the sixth rib, the sound will be tympanitic, owing to the stomach being subjacent.

Diminution of Clearness.—Whenever the density of the materials underneath the part struck is increased, there will be a diminution of clearness—varying from a slight degree to perfect dulness, in proportion to the increased density—with shortening in the duration of the sound. Slight pleuritic effusion, congestion and partial pneumonic condensation of the lungs, œdema and spasmodic asthma during the paroxysm, are the chief causes of a partially dull sound over the lungs in any part on percussion; while in pleurisy with great effusion, in hydrothorax, in pulmonary apoplexy, in complete condensation of the lung from pneumonia, in phthisis, in cancer of the lung or pleura, and over aneurismal tumors, there will be an absence of any resonant sound on percussion, or, in other words, perfect dulness. It must be remembered that where a thin layer of lung overlies a solid structure, strong percussion will bring out the dull sound of the solid substance, whilst gentle percussion will give a clear sound. This is seen in the part of the lung overlying the heart. The difference between slight and strong percussion should be remembered. The *cardiac dulness* is increased in extent in the following diseases, first, those that are non-cardiac—viz., atrophy of the lungs, solidification of parts of the lung adjacent to the heart, enlargement of the liver from below upwards, mediastinal tumors, aneurism of the great vessels, œsophageal tumors and ascites; secondly, those that are cardiac—viz., hypertrophy, dilatation, fat under the pericardium, engorgement of the right cavities, fluid in the pericardium, exudation into and cancer in or under the pericardium. The cardiac dulness is diminished chiefly by emphysema, and by atrophy of the heart.

Increase of Clearness.—Increased clearness and duration of sound, with excess of elasticity, is noted, where the relative quantity of air within the chest is increased, but not carried to such extremes as to interfere, by tension of the walls, with their vibration, as—for example—in deep inspiration, in pneumothorax, and at the upper part of the chest in hydro-pneumothorax, and in atrophy, hypertrophy, and emphysema of the lung. Increase of clearness and of duration of sound, with diminished elasticity, is observed where there is a surplus of air in the subjacent part, with considerable induration of tissue between the surface and the part containing that surplus—a combination of conditions sometimes met with in phthisis, when a superficial cavity in the lung has a thin, indurated, and adherent external wall.[1]

Tympanitic Sound.—This sound resembles the tone obtained from a drum, and is produced on percussing the stomach, or a portion of intestine filled with air, but never on percussing the *healthy* chest. When therefore it occurs, we may infer that a cavity filled with air exists beneath the spot percussed; and consequently in thoracic affections we obtain the clearest tympanitic sound in pneumothorax. It may also, however, be produced less perfectly in two conditions of the lungs, independently of pneumothorax—viz.: 1, in the emphysematous portions of lung which often surround lung tissue solidified from hepatization, tubercles, &c.; and 2, according to Skoda, when the lung is gradually recovering from the compression of fluid previously effused into the pleural sac.

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[1] See Dr. Walshe, op. cit., p. 71.

Amphoric Resonance and Metallic Tinkling.—Amphoric resonance—a modification of the tympanitic tone—is similar to that occasioned by striking a wine-cask, partially or entirely empty. Cavities, larger than are required for the production of the tympanitic sound, and in which air can vibrate, are essential to the production of this tone. The only diseases in which it is heard are pneumothorax, and in tubercular cavities of large size, having walls equably and generally condensed. When the cavities contain a small quantity of fluid, metallic tinkling will be frequently audible, from drops of the fluid falling from the upper part of the cavity into the liquid below.

Tubular Sound.—The tubular percussion-sound, elicited from an elastic tube filled with air, is natural only when produced over the larynx or trachea. It is heard, however, when any condition exists which brings the larger bronchial tubes unnaturally near the surface, or when any solid, sound-conducting substance is present between the bronchi and the surface. Thus it will be elicited in dilatation of the bronchi, in chronic consolidation of the lung, in some cases of pleuritic effusion, very rarely in pneumonia, in small tubercular cavities, and in cases where a cancerous mass exists around the bronchial tubes.

The Bruit de Pot Fele.—The cracked-metal sound, resembling, according to Laennec, the sound given by a cracked pot when struck, or rather that elicited by the child's trick of striking the knee with closed hands to convey the idea that they contain money, is generated in the lungs when a large cavity exists under the part struck, having thin elastic walls, and a free communication with the bronchial tubes. It seems to be produced by the sudden forcible ejection of air and fluid along the tubes communicating with the excavation. According to Dr. Stokes, it may sometimes be elicited in cases of bronchitis where the secretion is thin and has gravitated to the lower parts of the lungs. In order to hear it, the patient should be directed to open the mouth, and then the locality of disease should be suddenly and sharply percussed.

7. AUSCULTATION.

Auscultation—*ausculto*, to listen—signifies the investigation of internal diseases by the sense of hearing, a mode of investigating disease for the discovery and elucidation of which Laennec forever holds mankind his debtor. It may be *immediate*, when the ear is placed in apposition with the surface of the body, or *mediate*, when some conductor of sound, as a stethoscope, is placed between the ear of the auscultator and the person of the patient. Immediate auscultation may be employed with the best success in some cases ; the patient's chest should generally be covered with a soft towel or handkerchief, smoothly spread, and tightly drawn over the surface, and the examiner should take care that none of his hair intervenes between his ear and the chest of the examined, or sounds may be produced which will be readily mistaken for those proceeding from within. In the greater number of instances, however, mediate auscultation is to be preferred, a common hollow cedar-wood stethoscope being used as a conductor between the parietes of the chest and the ear. In employing this instrument it should be applied to the naked skin firmly, and held steady, just above the trumpet-shaped extremity, by the thumb, index, and second fingers ; all friction between it and the clothes should be guarded against ; both sides of the chest should be thoroughly explored ; and the posture of the observer should be free from constraint.

AUSCULTATION OF THE RESPIRATION.

On applying the ear to the healthy thorax, the air will be heard entering and filling the lungs and then leaving them, in perpetual succession. The sound caused by the ingress and egress of air, or, in other words, by inspiration and expiration, has been termed *the respiratory murmur;* it is caused by the vibration of the tubes through which the air rushes, according to well-known acoustic principles, and it varies in character according to the age of the subject, the sex—being louder in females than males,—and the part of the chest where it is heard, being spoken of as pulmonary or vesicular, bronchial, and tracheal.

Pulmonary or Vesicular Respiration is heard all over the chest in health, except in those parts where it is superseded by bronchial or tracheal breathing. The murmur is a sound of a gentle, soft, breezy character, heard with the movements of inspiration and expiration, but much more intensely with the former than the latter. The expiratory is shorter than the respiratory murmur in health; though in healthy respiration the inspiratory and expiratory murmurs follow each other so closely, that they may almost be said to be continuous. The vesicular murmur is much louder during childhood than in after-life, just as the whole process of respiration is then more active; hence a loud vesicular murmur is said to be *puerile.* It is also intensified by deep inspiration. Now although puerile respiration is a sign of health during the earlier periods of life, yet at other times it is not so, being indicative either of temporary excitement, or of the presence of disease in some part of the lungs. The respiration is sometimes said under these circumstances *to be harsh.* Thus, when one lung is rendered powerless from the compression of fluid effused by an inflamed pleura, or when a portion only of a lung becomes solidified, as in pneumonic hepatization, the intensity of the respiratory murmur will be increased in the healthy lung or in the unaffected parts of the diseased lung, owing to the necessarily increased functional activity of the same, the compensating powers of the healthy lung-texture being brought into play.

In place, however, of the respiratory murmur being increased, it may become diminished or suppressed, as will occur when, from any cause, air is prevented from freely entering the lungs. Thus it will be diminished in obstructive diseases of the larynx, trachea, or bronchi, in bronchitis, in partial infiltration of the lung with tubercle, in pneumonia, in pleurisy with limited effusion, and in some cases of pleurodynia, or even of old age, where there is feeble respiration from diminished action. So also it may be perfectly suppressed in complete obstruction of a bronchus, in pleurisy with abundant effusion, in pulmonary apoplexy, in spasmodic asthma during an intense paroxysm, and, very rarely, in infiltration of the lung with tubercle or other morbid matters; but under these conditions there will be other physical signs, such as dulness, to indicate disease.

The expiratory sound may be prolonged (prolonged expiration), and this occurs when there is any cause which interferes with the elasticity of the lung-tissue, or where there is any obstruction to the expiration of air. It is seen in phthisis, in emphysema, &c.

Bronchial Respiration is audible over the situation of the large bronchial tubes—*i. e.*, at the upper portion of the sternum, between the scapulæ on a level with their spines, and less clearly under the clavicles and in the axillæ. It is generally mixed with the vesicular murmur in health, than which it is harsher, more tubular, and blowing.

This phenomenon is heard, however, in certain morbid conditions, over parts naturally yielding the vesicular murmur, which it supplants ; it then indicates condensation of the lung from effusion into its air-cells and parenchyma, as occurs in the second stage of pneumonia, pulmonary œdema, pulmonary apoplexy, malignant or tubercular deposits, intrathoracic tumors, or a dilatation of the bronchi, with more or less solidification of the tissue around them, &c. It is clear that the lung so condensed becomes a better conductor of sound than healthy lung, and hence conducts the bronchial murmur to the ear of the auscultator ; the murmur being loud in proportion to the extent and degree of condensation, and the proximity of the condensed portion to the larger bronchi.

Another form of disordered respiratory action is *jerking* respiration. This is *general* in the early stage of pleurisy, in pleurodynia, and neuralgia ; in hemiplegia, spinal irritation, hysteria, and spasmodic affections of the air-passages, and *partial*, in solid infiltration into the lung and in pleuritic adhesion.

The Tracheal Murmur is heard normally over the larynx and trachea, and is more intense, drier, hollower in quality than the preceding ; in fact, it conveys the idea of air rushing through a tube of large calibre. When heard in situations where vesicular respiration alone exists in health, it is indicative of a cavity communicating with the bronchi, or of very dilated bronchi, and is then called *cavernous* respiration ; while if it assumes an *amphoric* character it is diagnostic of pneumothorax with pulmonary fistula.

Sounds caused by Morbid Secretion.—The sounds or murmurs which have just been treated of are all to be heard in the lungs during health, being misplaced as it were in disease ; those, however, which remain to be considered—viz., the secretion-sounds and the rubbing or friction-sound—are entirely adventitious phenomena. The sounds are produced by the passage of air through the air-tubes constricted by disease and more or less filled with secretion. The sounds caused by morbid secretion are as follows :

Dry Sounds	Sibilant rhonchus, in small tubes. Sonorous rhonchus, in large tubes. Dry crackle.
Moist Sounds	Small or fine crepitation. Large crepitation. Humid crackle, or gurgling.

Sibilus, or sibilant rhonchus, is a hissing, whistling, or wheezing noise, and occurs when the inflammation in catarrh or bronchitis has reached the small bronchi and vesicles, and has diminished their natural calibre, by rendering the membrane lining them tumid : it is a sound bespeaking some danger.

Rhonchus is a snoring or droning hum, like the cooing of a pigeon or the bass note of a violin. It belongs to the larger divisions of the bronchial tubes, and denotes their partial narrowing ; it is of much less importance than sibilus, and usually implies no danger. It may exist alone, as in bronchitis, or should the inflammation proceed, it will be conjoined with sibilus. When this rhonchus is very marked, the hand applied to the chest feels a distinct fremitus.

Dry crackle, the *craquement* of Laennec, resembles the sound produced by blowing into a dried bladder or crumpling up in the hand very fine tissue-paper, and conveys the impression of air distending lungs that have become more or less dry, and whose cells have been unequally but much dilated. It is only heard during inspiration in parts of the lung the seat of emphysema, and especially in interlobular emphysema.

Crepitation is a moist sound, of two varieties, according to the size of the tubes in which it is generated: there is no difference between the two kinds, except in degree, and they generally merge insensibly into each other. In common bronchitis, for example, after a certain time, the inflamed membrane ceases to be dry, and begins to pour out a stringy tenacious fluid ; rhonchus and sibilus then cease to be heard, their place being taken by crepitations—sounds resulting from the passage of air through a liquid, and directly occasioned by the formation and bursting, in quick succession, of numerous little air-bubbles. This is termed sometimes *subcrepitant râle*, or, if not very fine, *submucous râle*. *Large crepitation*, also designated *mucous râle*, is readily detected, as the air-bubbles are large ; it takes place in the larger air-tubes, and is indicative of the presence of serum, mucus, pus, or blood in the large bronchial tubes. *Small* or *fine crepitation*, the *crepitant râle* of Laennec—a good idea of this sound may be obtained from rubbing between the finger and thumb a lock of one's own hair, close to the ear—occurs in the very smallest ramifications of the bronchi and the air-vesicles themselves; it supersedes the vesicular breathing, and indicates the presence of a small quantity of fluid in the air-cells, a condition which may arise not only from inflammation of the lung, but from œdema, or from an effusion of blood into the vesicles—as in pulmonary apoplexy. In the greater number of cases, however, it is a pretty certain sign of the existence of pneumonia; it may be heard from an early stage of the inflammation until complete hepatization occurs, when it ceases, to reappear if the inflammation end in resolution instead of going on to gray hepatization or suppuration, being gradually succeeded—as the lung returns to its normal state—by large crepitation, and ultimately by vesicular breathing.

Thus it appears that rhonchus and large crepitation are respectively the dry and moist sounds of the larger air-tubes, sibilus and small crepitation of the minutest divisions of the air-tubes and ultimate vesicles of the lungs.

Humid crackle, or the cavernous rhonchus, or gurgling, of some authors, is characterized by a strongly marked mucous gurgling or bubbling sound, most apparent after a full inspiration, or a fit of coughing. When slightly marked it may be at the summit of either lung, indicative of tubercles beginning to soften; when at the middle of one or both lungs, it may result from the gurgling of fluid in a dilated bronchus; but when well marked it indicates the passage of air through fluid in a tubercular cavity, or a cavity produced as the result of abscess or suppurative pneumonia.

The term *mucous* rhonchus is used to that form of large crepitation which conveys the idea of air passing through a good deal of mucus. It is removed by coughing, heard in both inspiration and expiration, and occurs in bronchitis, catarrh, in phthisis and pneumonia, with much expectoration. It is the same as mucous râle.

Friction-Sound.—This murmur is generally difficult of detection by the ear alone, but if the hand be placed upon the affected part a sensation of rubbing (friction-fremitus) is generally perceived, which is then communicated to the ear by auscultation; it attends both movements of respiration, but is loudest and most prolonged during inspiration. It occurs in pleurisy, when, the polish of the healthy serous membranes being lost by the exudation of lymph, the rubbing of the costal upon the pulmonary pleura is distinguished. It of course ceases when the exudation of serum is sufficient in quantity to separate the costal from the pulmonary pleura, but returns as the fluid poured out becomes absorbed, continuing until the lymph itself is also absorbed, or until the opposed surfaces of the pleura become adherent. It may also occur when deposits of tubercles or carcinoma are so localized as to cause roughening of the pleura, or even when interlobular emphysema gives rise to the same conditions. It is best heard on deep inspiration. It occurs in pericarditis.

AUSCULTATION OF THE VOICE AND COUGH.

The voice, though chiefly produced in the larynx by the vibrations of the air, of the chordæ vocales, and of the trachea, and passing outwards by the mouth and nostrils, has its sound also partially propagated inwards to the lungs by the air in the trachea and bronchial tubes, occasioning a vibratory sensation or fremitus in the smaller bronchi, or even a more distinct "*vocal resonance*," as it is called, in thin persons having a large chest and strong sharp voice.

Bronchophony.—In certain morbid states, the voice becomes indistinctly audible over portions of the lung where it is not heard in health. This phenomenon, called bronchophony or bronchial voice, is developed by the same causes that render the bronchial respiration morbidly audible—that is to say, by condensation of the lung in the vicinity of large bronchial tubes; hence it is an important symptom in pneumonia and phthisis. Bronchial respiration and bronchophony are frequently heard together; but since the sound of the voice is much louder than the sound of respiration, bronchophony may often be heard before the lung has become sufficiently solid to render bronchial breathing audible.

Pectoriloquy.—When the stethoscope is placed on the trachea, the voice articulates itself into the ear as if it came from and through the instrument. This phenomenon, natural over the trachea, is a sign of disease when heard elsewhere, and is then called pectoriloquy; it is heard over cavities in the lung, words whispered by the patient are "resounded" through the cavity, and fall with peculiar distinctness on the ear. Pectoriloquy is generally caused by condensation of the lung around a cavity having free communication with the trachea through the larger bronchi; it may also arise from consolidation of the lung round a dilated bronchus. It is sometimes difficult, if not impossible, to distinguish a dilated bronchus containing fluid from a tubercular cavity.

Ægophony is a modification of bronchophony, consisting of a peculiar resonance of the voice, resembling the bleating of a goat or the voice of Punch, following or accompanying the words of the patient. Its usual position is at the lower and posterior part of the chest, near the larger bronchi; it is so peculiar that once heard it cannot be mistaken. Ægophony was supposed by Laennec to be produced only by the bronchial resonance of voice passing through a thin layer of fluid between the pulmonary and costal pleuræ, and consequently was thought to be pathognomonic of pleurisy. It has, however, also—though rarely—been heard in simple consolidation of the lung, when no fluid could be detected in the pleura; and although its occurrence under these circumstances has not been satisfactorily explained, yet it is necessary to remember it in practice. Still it appears probable that in the majority of cases ægophony is due to the presence of pleuritic effusion; and as it disappears when the effusion is great, it may be regarded as an index of the quantity of fluid present.

Morbid Phenomena of the Cough.—The remarks just made as to the voice, will apply also to that unnatural vocal sound—cough; a few additional observations only being necessary as to a very peculiar sound called *metallic tinkling*, which is sometimes heard during ordinary inspiration, but which generally requires the act of coughing to elicit it. This physical sign, likened by Laennec "to the sound emitted by a cup of metal, glass, or porcelain gently struck by a pin, or into which a grain of sand is dropped," is made up of the *tinkling* properly so called, caused by the fall of a drop of liquid from the upper part of a cavity into some liquid at the lower part, and of the *ring or resonance*, caused by the reverberation of the walls of the cavity, to which part of the phenomenon many stethoscopists apply the term *amphoric resonance.*

Metallic tinkling and amphoric resonance occur together only under two circumstances: 1. When a large cavity exists in the lung, containing a small quantity of thin pus, and communicating freely with the bronchial tubes; and 2, in pneumothorax, when there is a fistulous communication between the lung and the cavity of the pleura. The latter is the most frequent condition in which metallic tinkling occurs.

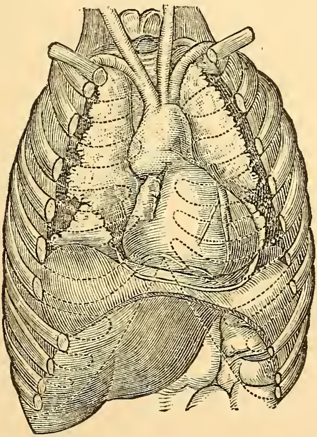
AUSCULTATION OF THE HEART.

The outline position of the heart has already been described, but it is necessary to give with more precision the general situation of the valves and parts of the heart in relation to surrounding parts in health for the purposes of comparison. Dr. Sibson has been good enough to give the editor the results of his most recent researches.

Position of the Heart in Health.—The heart and great vessels lie between the sternum and costal cartilages in front and the bodies of the vertebræ behind. The landmark of division between the heart and the vessels arising from it, is formed by the third costal cartilages. Dr. Sibson finds that in the strong the vessels reach to the lower border, and in the weak to the level of the upper border of these cartilages. The amount of the heart covered by lung has been described (see p. 203). The right cavities form the front part of the heart, save at the left border to about an inch in extent. The situation of the right auricle and the venæ cavæ, covered by the right lung, is just to the right of the sternum from the third to the seventh costal cartilage. The right ventricle is partly covered by lung and sternum at its upper and right parts, and partly not at its lower part (see Fig. 6, in which the lungs are turned back from off the heart). The boundary between the ventricle and auricle (right) corresponds to the tricuspid valve, and is situate behind the right border of the sternum from the fourth to the sixth costal cartilage. Only a little portion of the left ventricle, about an inch in width, comes to the surface to the left and at the apex. When, however, says Dr. Sibson, the left ribs and the dorsal vertebræ are removed, and the heart is looked at from the side and from behind, the left side of the heart is brought completely into view. The left cavities bear the same relation to each other and to the spinal column at the back of the chest that the right cavities bear to each other and to the sternum at the front of the chest, only each portion of the left side of the heart bears a little more to the left than the corresponding portion of the right side.

The mitral orifice is seated in front of the bodies of the seventh and eighth dorsal vertebræ, corresponding externally in the back to the spines of the fifth, sixth, and seventh vertebræ, and the space between the scapulæ just above the lower angles, and in the front to a spot behind the cartilage of the fourth rib on the left of the sternum. The aortic orifice is deep in the middle of the heart, and situate behind the left border of the sternum, close to the third interspace—that is, just below the third left costal cartilage. The pulmonary valves are situated more superficially, slightly higher—that is, behind the third left costal cartilage. The aorta runs up from left to right behind the sternum, with the vena cava on the right and the pulmonary artery to the left, the latter entering the second interspace (left), where it inclines backwards and divides, sending its branch right and left through the arch of the aorta ; the

Fig. 6.



bifurcation takes place at the level of the fifth dorsal spine. The aorta gives origin to the innominate artery at the centre of the sternum, then inclines backwards and to the left, giving off the three large vessels, the top of its arch being on a level with the middle of the manubrium anteriorly and the body of the fourth dorsal vertebra, or the third dorsal spine posteriorly. The descending aorta is just in front of and to the left of the bodies of the fourth and fifth dorsal vertebræ, having the œsophagus at first behind and then to the right. Most of these points may be studied by the aid of Fig. 5, p. 204, and Fig. 6, p. 229.

Effect of Respiration on the Heart.—Dr. Sibson states, that at the end of a deep inspiration the heart and its attached vessels are much lower in situation than at the end of expiration. The movements of the heart during respiration are vertical. The right cavities are enlarged and lengthened, and the great vessels are elongated, the pulmonary artery being widened and enlarged, and the aorta lessened in width.

The descent of the heart in relation to the walls of the chest is greatest at the lower boundary, where it may amount to two inches, that boundary descending from the upper to the lower end of the xiphoid cartilage, so that the heart is there immediately behind the abdominal muscles at the end of a deep inspiration.

Owing to the elongation of the cavities of the heart, the descent of its upper boundary, at the attachment of the great vessels, is less than that of the lower boundary. The upper boundary descends from the level of the third costal cartilage to that of the fourth, during a deep inspiration. The descent of the top of the arch, owing to the restraint to which it is subjected by the attachments of the great arteries, is considerably less than that of the upper boundary of the ventricles. As, however, the upper end of the sternum ascends to the extent of an inch during inspiration, the top of the arch, which at the beginning of a deep inspiration is situated behind the upper portion of the manubrium, at the end of a deep inspiration is situated behind its lower portion.

There is one more point worthy of notice. In the robust, in consequence of the heart being much covered by the existence of well-developed lungs, the impulse may be slightly perceptible. In the feeble the reverse is the case, and the impulse may be felt high up, "strong and extensive," or, as Dr. Sibson puts it, "The relative position of the heart and its seat of impulse follow the type of a deep inspiration in the robust, and that of an extensive expiration in the feeble."

Heart-Sounds.—In listening to the sounds of the heart, attention should be paid to the impulse, to the character and rhythm of the sounds, and to the situation and time in which they are most distinctly heard, as well as to the direction in which they are propagated.

To judge of the impulse, the spot where the apex of the heart beats against the chest-walls should be felt for, and the hand applied there. The stethoscope should then be placed immediately over the same spot, when the *first* or *systolic* sound will be heard. This sound has its maximum intensity over the heart's apex—below and rather to the inside of the nipple. Then placing the instrument above, and a little nearer the margin of the sternum, the *second* or *diastolic* sound will be most distinctly heard—sharper, shorter, and more superficial than the first. These two sounds may be imitated by pronouncing in succession the syllables *lubb*, *dup.*[1]

The first or systolic sound of the heart, dull and prolonged, coincident with the contraction or systole of the ventricles, the impulse of the apex against the ribs, and with the pulse of the large arteries, is probably chiefly caused by the contraction of the muscles, the closing of the valves, the current or wave of blood passing from one cavity into another, and perhaps by the shock of the heart's apex against the side. The second or diastolic sound, sharp and short, synchronous with the dilatation or diastole of the ventricles and with the recedence of the heart from the side, is agreed by all authorities to depend upon the sudden tension and closing of the semilunar valves, the recoil of the columns of blood in the aorta and pulmonary artery upon the upper surfaces of these delicate folds of membrane causing them to tighten with an audible check. Attempts have been made to assign the time occupied by each sound and the interval of repose. Dr. J. C. B. Williams divides the whole period from the commencement of one pulsation to the commencement of the next into five equal parts, allotting two of these to the first sound, one to the second, and two to the interval. This order of succession is called *rhythm* of the heart.

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[1] See Dr. Hughes Bennett's excellent "Introduction to Clinical Medicine." Second edition, p. 40.

The first sound is louder in the erect than the reclining position, after excitement or exercise, and in simple dilatation; both sounds are louder in dilatation and hypertrophy without valve disease, and functional excitement. The sounds are lessened in intensity by debility, by all degenerations of the muscular structure of the heart, and by pericardial accumulatious. Then the sounds may be freely transmitted through solid formations on the one hand, and rendered inaudible by an overlying emphysematous lung on the other hand.

There are some other changes in the sounds of importance; they refer to the duration of the sounds, that of the first being lessened in simple dilatation, and increased in hypertrophy; that of the second being lessened in anæmia and in attenuation of the sigmoid valves, and lengthened in thickening of the latter. The sounds may be irregular in severe mitral disease, and in fatty changes in the heart, in sudden rupture of a valve or one of the chordæ tendineæ, and in the formation of ante-mortem clots; reduplication sometimes occurs where there is an absence of harmonious action between the two sides of the heart. The second sound is intensified in marked mitral disease.

Adventitious Sounds.—These, produced on the surface of or within the heart, are termed respectively *friction* sounds and *murmurs;* the former are pericardial and the latter endocardial; murmurs are subdivided into organic and inorganic.

The sounds in the pericardium are produced by the rubbing together of the two surfaces roughened by inflammation, or the movement given by the heart's action to adhesions resulting from inflammation. These friction-sounds are sometimes called *pericardial murmurs.* Friction-sounds is the better term.

Most of the alterations in the internal lining membrane of the heart result from inflammation, which gives rise to a deposit of lymph upon or beneath the serous membrane. The valves thus lose their thinness and transparency, become thick, puckered up, and adherent to each other or to the opposite walls of the channel. Independently of inflammation, the valves may become covered with warty vegetations or excrescences, or they may be converted into bone, or in old persons be affected by atheroma. When affected in any of the foregoing ways they will act ineffectively, and an organic bellows-murmur will result from the rush of blood over the roughened surface, or through the narrowed orifice guarded by the valves. So-called inorganic murmurs result from preternatural thinness of blood, and are anæmic. The first matter for notice then is that of—

Pericardial Friction-sounds or Murmurs.—Pericardial frictions vary much in intensity, being sometimes so delicate that the closest attention is requisite for their detection, sometimes so loud that they can be heard over the whole cardiac region. Though more singular and varied than the friction-murmurs present in peritonitis or pleuritis, yet they have the same *superficial* rubbing, or to-and-fro character; they are generally also double, as they result from the movements of the heart, and are not heard at the seats of endocardial murmurs. The rougher the lymph, and the less the serum effused with it, the louder will be the friction-murmur. The rubs are generally unequal in length, one only may be audible, and in young subjects with thin and yielding chests they are increased by pressure, and in adults frequently by expiration; these friction-sounds are limited to the cardiac region, and not transmitted along the vessels. The friction-sounds may disappear in a few hours on the effusion becoming sufficient to separate the pericardial surfaces from each other, reappearing as the serum becomes absorbed, and remaining audible either until the membrane becomes smooth and healthy, or until it becomes adherent. The friction-murmur is pathognomonic of pericarditis. When the hand is placed over the pericardium a fremitus may often be felt. When—as often occurs—endocarditis accompanies pericarditis, a bellows-murmur, from fibrinous deposits in the texture or on the surface of the valves, will coexist with the pericarditic friction-murmur, and remain audible long after its cessation.

The following are the points of distinction as between pericardial and endocardial murmurs, as given by Dr. Walshe to his class. The pericardial have a rubbing quality; they are superficial in character; they are abruptly limited and not transmitted in the course of endocardial murmurs; they change their precise seat and intensity from hour to hour; there is a want of perfect synchronism with the heart-sounds; they are sometimes accompanied by friction-fremitus; they are rougher than endocardial murmurs, and they are intensified by pressure, and often when single become double by pressure—an occurrence diagnostic of pericardial friction.

There are two exceptional states in which modifications of the pericardial friction occurs—the one when there is exudation matter around the great vessels at the upper part of the pericardium, then a clicking sound may be heard, the other when there are pericardial adhesions, then a churning sound, due to the stretching or motion given to the adhesive material, may be heard about the apex. The history of the cases would point to antecedent pericarditis. It may be mentioned that in some instances where there is pleuritis near the heart, the friction-sounds may be rhythmical, as the heart's action; but it will be found that if the respiration be stopped, the friction-sound will cease with at least some of the heart's beats, being increased also by inspiration and diminished by expiration, whilst it is heard not over, though near, the cardiac region.

The next matter to notice is

Endocardial Murmurs.—These have been aptly compared to the blowing of a pair of bellows; hence the term *bellows-murmur*, or *bruit de soufflet.* A bellows-murmur may be harsh, or rough, or cooing, or whistling, or musical, but these modifications are of little importance: of whatever nature, it is caused by the presence of obstructions—it may be the inability of the valves to close properly, so that the blood regurgitates—which impede the free flow of blood through the heart and its great vessels—producing an organic murmur; or by a supposed peculiar condition of the blood—giving rise to an inorganic murmur.

The lining membrane, valves, and orifices of the left side of the heart are much more frequently diseased than those of the right; so much so, that it is almost a question whether disease of the tricuspid valves can be accurately diagnosed. Diseases of the left side chiefly affect the arterial pulse, giving rise to irregularity and inequality; those of the right side affect the venous circulation, causing regurgitation into the jugular veins—a condition known as the venous pulse. Dropsy is more often connected with disease of the right than of the left cavities. Organic murmurs will vary in intensity according to the degree of obstruction, the force with which the blood is propelled from the heart through the obstruction, and the state of the blood—the thinner the blood the louder the murmur. A small amount of obstruction with forcible heart's action will produce a louder murmur than a more weakly acting heart, and considerable valvular disease. Organic murmurs are persistent, and are heard most distinctly over the valves, being transmitted along the great vessels and away from the heart.

The following are the three chief points to be specially attended to in the recognition of the different endocardial murmurs: (*a*), time (*b*), point of greatest intensity, and (*c*), direction in which transmitted. There are some other particulars as to duration, the quality, and the pitch, which are of secondary importance. The three points named are the important ones to bear in mind in the diagnosis of endocardial murmurs. With regard to time, murmurs are systolic or diastolic, therefore each orifice of the heart may be the seat of these two kinds of murmurs. A systolic murmur at the base of the heart over the aortic or pulmonary valves will imply obstruction to the passage of blood from the heart (it is called constrictive or obstructive murmur), but at the apex it will signify regurgitation from the ventricles to the auricles. A diastolic murmur at base will imply regurgitation through the aortic or pulmonary artery valves (regurgitant murmur), but at the apex, obstruction to the entrance of blood into the ventricles. The point of greatest intensity will determine the seat at which the abnormal sounds are produced, for murmurs are transmitted over a large area sometimes. Supposing a murmur be heard at the middle of the cardiac region, if it grow fainter, and perhaps be lost when traced down to the apex, but gets louder and more distinct, until most audible over the aortic valves, we know that the seat of the disease, as shown by the point of greatest intensity of the murmur, is at the aorta. Then the third point—viz., the direction in which murmurs are transmitted—comes in to assist. Supposing a murmur is generated at the aortic orifice, it will be conducted upwards and to *the right* along the column of blood in the aorta; if it be generated in the pulmonary artery it will be transmitted not to the right but to the left. The *systolic* murmurs, then, are, *at base*, aortic obstructive and pulmonary obstructive; *at apex*, mitral and tricuspid regurgitant. The *diastolic* are, *at base* aortic regurgitant and pulmonary regurgitant, *at apex* mitral obstructive and tricuspid obstructive, the points of greatest intensity in each case, being over the sites of the several valves. The tricuspid obstructive and pulmonary regurgitant murmurs are seldom if ever heard.

The special characters of the separate murmurs will now be given in connection with a description of the diseased conditions of the several valves.

Aortic orifice.—Disease of this opening giving rise to aortic constrictive (systolic) and aortic regurgitant (diastolic) murmurs is not uncommon. If the affected valves diminish the aortic orifice during systole—or contract it —so as to prevent the blood from freely flowing out of the ventricle, a systolic (constrictive) murmur will result, which will be best heard at mid-sternum, opposite the third interspace or fourth cartilage, being transmitted upward to the *right* second cartilage, and sometimes even in the carotids; the sound diminishing as the stethoscope is moved towards the apex of the heart. If the valves close imperfectly, permitting reflux of blood from the aorta, the morbid sound will be diastolic, and the murmur is a regurgitant one; its point of greatest intensity is at the fourth interspace at mid-sternum; it is transmitted downwards to the ensiform cartilage—that is to say, rather to the right than the left of the apex, it is transmitted upwards (being diastolic) to the second right cartilage. The pulse of aortic regurgitant disease is peculiar, being generally sudden and sharp, and without any prolonged swell of the artery; Dr. Hope called it a *jerking* pulse. It is a visible pulse, a tortuous pulse as it is called, which is diagnostic. The short second sound of the heart will also be muffled and indistinct, with an aortic regurgitant murmur. Sometimes we have both these conditions of the aortic valves in the same case, a double bruit or bellows-sound will then be produced.

In aortic obstructive disease we may have a loud murmur with little valve disease. When the obstruction is marked or long continued, the results are hypertrophy and dilatation of the left side of the heart, and later on lung congestion influencing the right side of the heart. Aortic regurgitation is a much more serious affair. It is followed by hypertrophy and dilatation, especially of the left auricle, and is often followed by sudden death; indeed, it is the form of heart disease in which this accident mainly occurs.

Mitral orifice.—The mitral valves which guard the left auriculo-ventricular orifice, may become thickened or ossified, the effect of which is to prevent their closing the auricular orifice during systole, as well as not to permit of their lying flat against the walls of the ventricle, so as to allow the blood to pass freely along during the diastole. In some cases the orifice is almost rendered a permanent oval slit. A double bruit may perhaps be present; the systolic or *regurgitant* murmur is caused by the flow of the blood from the ventricle into the auricle; the second, diastolic, or *obstructive*, is due to the impediment to the passage of the blood from the auricle to the ventricle; it is but rarely heard, however, the force of the flow of blood from auricle to ventricle often not being sufficient to produce a murmur when the disease of the valves is even marked. On the other hand mitral regurgitant is loud. The obstructive murmur is heard most distinctly at the apex (left); the obstruction is a very grave matter, and is followed by hypertrophy and dilatation of the left auricle, clotting in the appendix, pulmonary apoplexy, œdema of the lung, distension of the right side of the heart, and intensification of the second sound of the heart at the base. Symptoms of irregular action of the heart show themselves also. Mitral regurgitation is not so formidable; its murmur is systolic, it is most distinctly audible at the left apex, and is transmitted outwards and backwards, being often heard very distinctly at the angle of the scapula.

Pulmonary artery orifice.—The semilunar valves of the pulmonary artery are very rarely diseased; so rarely, that any organic alteration in them is a pathological curiosity. When, however, a systolic bellows-murmur, having its point of greatest intensity at the third left cartilage, can be traced upwards and towards the left, and when this murmur cannot be heard in the subclavian or carotid arteries, we may assume that it originates at the orifice of the pulmonary artery, and is an obstructive murmur. A diastolic murmur, indicating regurgitation is not observed. The pulse will be unaltered. The pulmonary artery may be congenitally diseased or malformed, but the obstruction which occasions a murmur is usually due to pressure from without, either by a mass of tubercle in the lung adiacent, or the pressure exerted by a yielding sternum in forced expiration or with the stethoscope.

The tricuspid orifice.—The valves guarding the right auriculo-ventricular opening are also but seldom found otherwise than healthy. No diastolic murmur practically occurs, the flow of blood from auricles to ventricles is not strong enough to generate one with valve disease. The only murmur here, is "tricuspid regurgitation." Its point of greatest intensity will be at the lower part of the sternum or the ensiform cartilage, and it will be transmitted equally in all directions. There may be insufficiency of the auriculo-ventricular valves without murmur. When the disease is marked the blood flows freely back at each systole of the heart into the veins, producing turgescence, with pulsation of the jugular veins at every ventricular systole. The ultimate results of tricuspid regurgitation are clotting of blood in the right auricle and its consequences, anasarca, and congestion of internal organs, ex., liver, kidney, &c.

The following is, according to Dr. Walshe, the relative frequency of organic murmurs: (1) Mitral regurgitation. (2) Aortic obstructive. (3) Aortic regurgitation. (4) Mitral obstructive. (5) Tricuspid regurgitation. (6) Pulmonary obstructive.

Inorganic Murmurs—much less formidable than the organic—accompany impoverished conditions of the blood, especially on those depending on a defect in the red globules; they are heard in those conditions of the system known as anæmia, chlorosis, &c., and result from starvation, loss of blood, sexual excesses, and other circumstances producing great depression. On auscultation at the base of the heart, a loud systolic bruit or bellows-sound will frequently be detected over the aortic and pulmonary valves, but it is only very slightly conducted along the aorta. It is not heard at the apex. By placing the stethoscope over the jugular vein, especially over the right, a continuous humming or cooing, or even whistling sound—the *bruit de diable*—will be heard; a sound which is probably caused, as Dr. Ogier Ward first pointed out, by the descent of attenuated blood through the great cervical vessels; although some authorities regard the carotid artery as its seat. In persons with thin and yielding chests, the pressure over the pulmonary artery with the stethoscope, especially in expiration, may generate a systolic murmur, due to the narrowing of the artery by the pressure of the chest-wall: it is not heard in inspiration. In chorea, owing to the disordered action of the papillary muscles, a systolic murmur may be heard at the left apex (mitral regurgitant). It may disappear during sleep, when the choreic movements cease.

Physical Diagnosis of Arterial and Venous Disease.—There are certain phenomena connected with the arteries and veins in disease that may be briefly mentioned here. The arteries are seen to pulsate visibly in aortic regurgitant disease and diseased conditions of the vessels themselves, when their elasticity is lost. There are certain arterial murmurs sometimes heard, when the composition of the blood is altered, as in anæmia, or when the lining membrane of the vessel is roughened or the vessel itself is dilated, and when there is any communication between an artery and a vein, or the calibre is altered by pressure, as from a tumor. The murmurs of an inorganic nature are soft and intermittent. Of late years special attention has been called to the frequent existence of a murmur in the subclavian artery independent of any disease in the vessel. The cause of the great majority of instances of subclavian murmur, Dr. Palmer[1] believes to be the pressure of the first rib on the under surface of the artery of the same side, whereby a ripple is produced in the current of contained blood. Where the murmur is only heard during inspiration, the pressure of the rib is brought to bear on the artery, through the elevation of the former, by the scalenus anticus; when the murmur is constant, the bone and artery are originally and naturally in contact. The fact of the rib being always grooved, to receive the artery, shows the contact to be no departure from health or natural arrangement.

That the murmur is found much more frequently on the left side than on the right, is due to the different directions taken by the two subclavian arteries with reference to the first rib on each side, the left ascending behind and hooking over the one, while the right artery holds, comparatively, an almost straight course over the other.

Subclavian murmur is much more common among working men than among the richer classes and females: this is due to the fact, that active and continued muscular exertion increases the power and range of respiratory movements, notably, therefore, the elevation of the first rib by the scalenus anticus.

Subclavian murmur, consequently, is nowise incompatible with perfect and enduring health.

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[1] *Lancet*, April 2, 1864.

Dr. B. W. Richardson thinks the murmur to be caused by pressure on the artery against the first rib, by a subclavian muscle hypertrophied by labor. The fact that the sound is so much more common on the *left* side would militate strongly against this theory, because the *right* muscle is the most used and strengthened.

Murmurs in connection with aneurisms will be referred to again.

Pulsation may be seen and murmurs heard in the veins. The former is usually seen in the external jugulars in connection with tricuspid regurgitation and hypertrophous disease of the right side of the heart. The jugulars are distended in tricuspid disease, and from pressure on the cava or innominate veins by tumors within the chest. Venous murmurs are heard in anæmia over the larger veins, they are increased by accelerated heart's action, and are not intermittent.

CHAPTER VIII.

GENERAL OBSERVATIONS ON THE DIAGNOSIS OF THORACIC DISEASES.

In exploring the diseases of the lungs and heart by the physical methods of diagnosis, it must be remembered that the signs derived from these sources are not to be solely trusted to, but that every circumstance bearing upon the case under examination is important, and must consequently be taken into consideration if we would wish our judgment to be unbiassed and our opinion correct. In order to aid the student in studying the chief pulmonary and cardiac affections, we have devoted the present chapter to the consideration of their general diagnosis, and trust it will not be thought unworthy of the close attention of the reader.

BRONCHITIS.

Inflammation of the bronchial tubes may be acute or chronic.

Acute Bronchitis is a common and a dangerous disorder, more especially on account of the frequency with which the inflammatory action spreads to the vesicular texture of the lungs.

The symptoms consist of fever, a sense of tightness or constriction about the chest, hurried respiration with wheezing, severe cough—at first dry, and then accompanied by expectoration of a more or less viscid glairy fluid which subsequently becomes purulent. The pulse is frequent and often weak, it is influenced by the cough; the tongue is foul; there is headache (oftentimes frontal from the coughing), lassitude, and great anxiety. During the cough the face becomes purple or crimson, showing obstruction to the general circulation. There is a feeling of soreness and tightness in the chest.

On practising auscultation in the early stage of the inflammation, two *dry* sounds will generally be heard—viz., *sibilant* and *sonorous rhonchi*, both of which indicate that the air-tubes are partially narrowed—that the mucous membrane lining them is indeed dry and tumid. Sonorous rhonchus in itself need give us no anxiety, as it belongs entirely to the larger divisions of the bronchial tubes ; sibilus, on the contrary, bespeaks more danger, since it denotes that the smaller air-tubes and vesicles are affected. After a time, the inflamed mucous membrane begins to pour out fluid—a viscid, transparent, tenacious mucus is exhaled ; this constitutes the second stage of the inflammation. Two very different sounds to those just noticed are then to be detected, mucous, and submucous, or subcrepitant râles—often called the *moist* sounds. As the air passes through the bronchial tubes it gets mixed, as it were, with the mucous secretion, so that numerous air-bubbles keep forming and bursting. When this occurs in the larger branches it gives rise to mucous, when in the smaller, to submucous or subcrepitant râles. We have therefore *sonorous* and *mucous* rhonchus or râles, as, respectively, the dry and moist sounds of the larger air-passages ; *sibilus* and *subcrepitant* rhonchus as those of the smaller branches. On practising percussion, no appreciable alteration in the resonance of the chest will be discoverable. If relief be not afforded by the copious expectoration, or by remedies, the disease assumes a more dangerous character, the strength becomes much reduced, signs of great pulmonary congestion ensue, and symptoms of partial asphyxia follow, soon ending in death. In favorable cases, however, the affection begins to decline between the fourth and eighth day, and shortly either entirely subsides, or passes into the chronic form. When the finer tubes are affected, we have what is termed *capillary bronchitis* present. It is seen in infants, children, and old people, and in those whose lungs are emphysematous, or who have heart disease. The disease attacks the posterior and lower part of the lung, and the rhonchi are fine. Sonorous and sibilant rhonchi are not present, or soon go, but we have subcrepitant râles, with marked dyspnœa, and the surface gets very livid from the non-aeration of the blood. The prognosis is grave.

Chronic Bronchitis is very common in advanced life. The slighter forms are indicated only by habitual cough, some shortness of breath, and copious expectoration. The majority of cases of winter cough in old people are examples of bronchial inflammation of a low lingering kind. In emphysematous subjects it may be a severe disease, with marked symptoms of obstructed circulation, inability to lie down, &c. It may arise idiopathically, or it may follow an acute attack.

PLEURISY.

Pleuritis, or pleurisy, are terms applied to inflammation of the pleura—the serous membrane investing the lungs and lining the cavity of the thorax. The inflammation is of the adhesive kind, and is accompanied by the pouring out of serum, of coagulable lymph, of pus, or of blood.

The disease is ushered in with rigors, followed by fever, and an acute lancinating pain in the side, called a stitch, which pain is aggravated by the expansion of the lung in inspiration, by coughing, by lying on the affected side, and by pressure: there is also a short, harsh cough, the skin is hot and dry, the cheeks flushed, the pulse hard and quick, and the urine is scanty and high-colored. If we listen to the painful part of the chest at the commencement of the attack, we shall hear the dry, inflamed membranes—the pulmonary and costal pluræ—rubbing against each other, and producing a *friction-sound;* if the hand be placed on the corresponding part of the thorax, this rubbing may also be felt. But the sound soon ceases; for either the inflammation terminates in resolution and complete recovery, or the roughened surfaces become adherent, or they are separated by the effusion of serum, and a kind of dropsy results, known as *hydrothorax.* If the pleurisy has been severe, the effusion becomes excessive (it may vary from an ounce to several pints), and the fluid accumulating in the sac of the pleura compresses the yielding lung, suspends its functions, displaces the heart, and somewhat distends the thoracic parietes. When the serous fluid is mixed with pus, the disease is termed *empyema.* If we listen to the chest in hydrothorax or empyema, we shall find the respiratory murmur diminished, in proportion to the quantity of fluid thrown out: where this is excessive and the lung is compressed backwards—flattened almost against the spinal column—no vesicular breathing at all will be audible over the site of the fluid, but instead we shall hear the air passing into the larger bronchial tubes, while the voice will be also abnormally distinct over the condensed lung which acts as a conductor of sound; we then say that *bronchial respiration* and *bronchial voice*, or *bronchophony*, exist over the compressed lung. The bronchophony may be accompanied by a tremulous noise, resembling the bleating of a goat; it is then termed *œgophony*. If the lung be completely compressed, so that no air can enter even the bronchial tubes, then no sounds of any kind will be heard; but on the healthy side the respiration will be more distinct than natural—will be *puerile*. There will also be dulness on percussion all over the affected side, if the pleura be full of fluid; if it be only partially filled, we can judge of the quantity by placing the patient in different attitudes; for since the fluid will gravitate to the most dependent part of the cavity, so it will carry the dull sound with it. We shall also often be able to judge of the amount of the effusion by the dyspnœa which the patient suffers from, since this will, of course, be most urgent when the lung is most compressed. At this stage also the sufferer is unable any longer to lie on the sound side, clearly because the movements of the healthy lung would be impeded by the superincumbent weight of the dropsical pleura; the pain, moreover, no longer prevents his resting on the diseased side. If we measure the two sides of the chest, the side containing the effusion will be found the largest; we must remember, however, that in many persons the right half of the chest is naturally rather larger (half an inch) than the left.

After a time the symptoms begin to decrease, and absorption of the effused fluid commences. Supposing the lung to be bound down by adhesions, it will not expand in proportion to the absorption of the fluid; the affected side will then shrink inwards, and instead of any longer remaining larger than the sound side, will become smaller.

Chronic pleurisy is often secondary to tubercle. It is difficult to say with certainty when pus (empyema) exists in the pleura, but we may diagnose with tolerable accuracy if there be hectic, if the pulse be quick, and there be exacerbations of fever, loss of flesh, absence of pain, profuse sweating at night, clubbing of the finger ends, or the passage of pus into the lungs or elsewhere. Occasionally the impulse of the heart is conveyed through the fluid, and then we have what is termed "pulsating empyema."

PNEUMONIA.

Pneumonia, or inflammation of the substance of the lungs, consists of three degrees or stages—viz., 1, that of engorgement; 2, that of red hepatization; and, 3, that of gray hepatization or purulent infiltration. In each stage there is fever, high temperature, more or less pain in some part of the chest—most severe at the commencement of the attack; accelerated and oppressed breathing; occasionally delirium; cough; and expectoration of viscous, rust-colored sputa, by the fourth day, which unite into a mass so tenacious, that even inversion of the vessel containing the collection will not detach it.

In the first stage, or that of engorgement, the substance of the lung becomes loaded with blood or bloody serum. It is heavy, of a dark red color externally, and on cutting into it a quantity of red, frothy serum escapes, while its appearance somewhat resembles the spleen. It is more friable than natural; has lost its elasticity; pits on pressure; contains less air than natural. If we listen to the chest when the lung is in this condition we shall hear very fine crepitation, which is known as *small crepitation*, or *crepitant rhonchus*. If a lock of one's own hair be rubbed between the finger and thumb close to the ear, a sound will be produced resembling it. The natural respiratory or vesicular murmur is still heard mingled with this minute crepitation, especially at first; as the inflammation advances, however, the healthy sound is quite displaced by the morbid one. Percussion also, at first, affords the natural resonance, which gradually becomes obscured. The respirations are greatly increased out of proportion to the pulse.

If the inflammation proceed, it passes into the *second stage, or that of hepatization*, in which the spongy character of the lung is lost, and it becomes hard and solid, resembling the cut surface of the liver—whence it is said to be hepatized. If we now practise auscultation, neither the minute crepitation nor the vesicular murmur is any longer perceptible. *Bronchophony*, however, often exists, more particularly if the inflammation be seated near the upper part or in the vicinity of the root of the lungs; it is accompanied also by *bronchial respiration*, these sounds being conducted by the solidified lung. The sound on percussion is dull over the whole of the affected part; the vocal fremitus is increased.

Advancing still farther, we now have *the third stage of pneumonia, or that of gray hepatization, or purulent infiltration*, which consists of diffused suppuration of the pulmonary tissue. Circumscribed abscess of the lung is very uncommon, but diffused suppuration is a frequent consequence of inflammation. There are no physical signs by which this stage can be diagnosed, until part of the lung breaks down and the pus is expectorated; *humid crackle* or *large gurgling crepitation* will then be heard.

If the inflammation subside before the stage of purulent infiltration, as it fortunately often does, then the hepatized condition may remain permanent, or may gradually cease; in the latter case we shall find the air slowly re-entering the lung, as will be indicated by a return of the minute crepitation, mingled with—and subsequently superseded by—the healthy vesicular murmur.

Occasionally, in depressed constitutions, acute inflammation of the lung terminates in *gangrene*. The characteristic symptom of such an occurrence is, an intolerably fetid state of the breath, resembling the odor which proceeds from external gangrenous parts. Unless the mortified portion be small, death will, in all probability, result.

Pneumonia may affect one lung or both, or, technically speaking, may be double or single. The right lung suffers from inflammation twice as often as the left; about once in eight cases both are affected. The average duration of the disease is about ten days. The lower lobes are more obnoxious to inflammation than the upper. In secondary pneumonia from blood poisoning, as in pyæmia, the middle portion of the lung, the upper part in fact of the lower lobe, is affected.

Pneumonia often occurs with bronchitis. It may occur with or without pleurisy; when the pneumonia forms the chief disease, the double affection is termed *pleuro-pneumonia;* when the pleurisy predominates, it is sometimes called *pneumo-pleuritis.*

ASTHMA.

Asthma may be defined as consisting of paroxysmal attacks of dyspnœa, accompanied with a wheezing sound of respiration, the attacks ending, generally in a few hours, with mucous expectoration more or less abundant. The paroxysms appear to be due to obstruction of the smaller bronchi from tonic contraction of the circular muscular fibres. The term asthma has been used to designate severe attacks of dyspnœa, due to various and different causes—emphysema and heart disease (cardiac asthma); but it is best to limit it to dyspnœa dependent on spasm of the bronchial tubes. The post-mortem appearances of true asthma are nil, or slightly congestive; but bronchitis and emphysema are aften associated with asthma.

A fit of asthma is either preceded by various digestive, or nervous, or other disturbances; or it occurs suddenly, without any warning. The patient awakes an hour or two after midnight with a sensation of suffocation, or constriction about the chest; the efforts at inspiration are convulsively violent; the expiration is prolonged and comparatively easy; both acts, but especially the first, are attended with wheezing, and occasionally rhonchus and sibilus are heard in place of the natural respiratory murmur. Various postures are assumed to facilitate the attempt at filling the lungs; the patient stands erect, or leans his head forwards on his hands, or rushes to the open window—at which he will remain almost for hours gasping for air. The pulse is small and feeble; the eyes staring; the countenance anxious; the skin cold and clammy. His whole appearance is most distressing, and he looks beseechingly at the practitioner for relief from his misery. Then after a certain lapse of time, comes a remission; cough ensues, and with the cough expectoration of mucus; and soon the paroxysm ceases, to allow the sufferer to fall into the long-desired sleep.

When the attack ceases with expectoration, the case is said to be one of *humid* or *humoral* asthma; when without, it is called *dry* asthma. Both forms are often connected with emphysema of the lungs, and with disease of the heart. When the attacks are merely nervous, the patient enjoys good health during the intervals; when there is chronic bronchitis, or emphysema, or heart disease, the symptoms of these conditions remain more or less prominent.

Repetition of asthmatic fits often leads to dilatation of the right cavities of the heart, and to insufficiency of the tricuspid valve; this occurs most frequently when there is emphysema.

EMPHYSEMA.

The diseases of the lungs thus denominated are of two kinds. One consists essentially of enlargement of the air-cells, and obliteration of their vessels; this is called *vesicular* or *pulmonary emphysema*. When, on the other hand, there is infiltration of air into the interlobular areolar tissue, or into the sub-pleural areolar tissue, the disease is known as *interlobular emphysema.* Both forms give rise to habitual shortness of breath, with occasional severe paroxysms of dyspnœa or orthopnœa, resembling asthma; they are at all times very distressing complaints, and quite unfit the sufferer for any active occupation. Emphysema is a common cause of dyspnœa, and it leads to hypertrophy and dilatation of the right side of the heart, and general venous congestion.

Emphysema may be acutely produced in children from simple over-distension of the air-cells, as in bronchitis. In the common form there is dilatation of the air-cells with hypertrophy of their walls—hypertrophous emphysema; the lungs are pretty generally affected, and are dry, pallid, and feel soft; on opening the thorax they bulge out. There may be dilatation with atrophy of the tissue where the chest is small; and lastly, the emphysema may be local, as around tuberculous masses or cicatrices in the lung, the loss of bulk being supplied by the distension of a certain number of air-cells.

The physical signs consist of unnatural clearness and resonance on percussion, while only a very indistinct vesicular murmur is heard on auscultation. The diseased side of the thorax is also more prominent and rounder than the healthy one. Thus, as regards percussion and auscultation, emphysema affords results the reverse of most other affections: the disease consisting, as it were, of a superabundance of air, which is not in motion, and hence does not pass away, there is more resonance on percussion, but less respiratory sound on auscultation.

PNEUMOTHORAX.

This is characterized by the presence of air in the pleural cavity.

The jagged ends of a fractured rib will often wound the pulmonary pleura, and thus allow air to escape from the lung into the pleural sac. The same condition may arise from an external wound, or from ulceration during the extension of a tubercular cavity. When the pleura contains air alone, we say there is *pneumothorax;* when, as generally happens, there is liquid with the air, we call the disease *hydro-pneumothorax*, or *pneumothorax with effusion.*

The physical signs of pneumothorax are, great resonance on percussion, with indistinctness of the respiratory murmur on auscultation; while the patient's voice and cough give rise to a ringing metallic noise, like that produced by blowing obliquely into an empty flask, and hence called *amphoric resonance.* When there is also liquid with the air, we obtain in addition, on practising succussion, a sound known as *metallic tinkling*, which results from a drop of liquid falling from the upper part of the cavity into the liquid below, and causing a little splash.

HÆMOTHORAX.

This is the term given to the condition in which blood escapes into the pleural cavity, from injury, ruptured lung, cancer of the pleura, &c., and in scurvy and purpura. The physical signs are those of hydrothorax, with the symptoms of concomitant diseases, and of loss of blood, perhaps.

PHTHISIS.

"The name of Phthisis [from *φθίω*, to waste away] has usually been regarded, until very recently, as synonymous with tubercular disease of the lungs. The time, however, seems now to have arrived when it may advantageously be allowed that several diverse affections, radically distinct from each other, should be included under the common designation of phthisis or pulmonary consumption. Instead therefore of restricting these expressions to indicate that morbid condition which arises from the deposit of tubercles in the lungs, they ought to be employed as generic terms for those pulmonary diseases which are characterized at first by progressive condensation, and subsequently by suppurative degeneration with excavation, of the affected portions of lung-tissue; these local changes being in some instances preceded, in others only followed, by constitutional disease.

"What then are the diseases which lead to ulceration and destruction of the lung-tissue—in other words, what are the varieties of phthisis? Arranged in the inverse order of their importance, we are at present justified in recognizing the following:

"(1) *Hemorrhagic* and *embolic* phthisis; in which there is cheesy disorganization and disintegration of blood-clots (after pulmonary extravasation), or of deposits produced by pulmonary emboli from the liver or veins, as well as of those portions of lung-tissue affected by the foreign matter.

"(2) *Bronchial* and *pneumonic* phthisis; attended with ulceration of the bronchi and air-sacs, as well as with cheesy degeneration and disintegration of any bronchial or pneumonic exudations or deposits which have occurred. This variety should include those cases hitherto described as forms of mechanical bronchitis; in which the morbid action is set up by the inhalation of different particles of matter that irritate the tubes and their terminal extremities—the air-sacs. We have thus the so-called grinders' asthma or knife-grinders' rot; carbonaceous bronchitis, or black phthisis, or miners' asthma, occurring in miners from the inhalation of the lamp-smoke, and the inspiration of the carbonic acid gas formed in the pits; millstone-makers' phthisis, observed in stonemasons and others; and cotton pneumonia, or cotton phthisis, met with amongst the operatives in cotton-mills.

"(3) *Syphilitic* phthisis; being that condition in which there is deposition or infiltration of gummatous matter through more or less of the substance of the lungs, with subsequent cheesy degeneration. It has already been shown that a chronic erythematous inflammation of the mucous lining of the bronchi may occur as a part of the constitutional lesions of syphilis.

"(4) *Fibroid* phthisis (described by some authors as cirrhosis of the lung, interstitial pneumonia, &c.) is usually that state in which systemic disorder localizes itself, more or less completely, in one or both lungs in the form of a fibroid exudation. Occasionally, perhaps, the disease is local—confined to the lung, When of constitutional origin, the general affection may be due to rheumatism or gout, syphilis, an unhealthy mode of life, abuse of alcoholic drinks, &c. Sometimes also, in addition to the pulmonary mischief, there is a similar degeneration of the endocardium, liver, kidneys, capsule of spleen, and other organs. The leading features of the lung mischief are very characteristic; this organ being found heavy and tough, indurated and contracted, either by fibroid tissue or by a fibrogenous material involving dilated bronchi. Moreover, portions, but especially the inferior lobes, are invaded by cheesy deposits and small cavities. The tough fibrogenous exudation is either identical with amyloid substance, or nearly related to it. The pleura is occasionally much thickened, having fibrous bands passing from it into the lung-tissue. The left lung is more frequently invaded than the right; but both will be involved more often than one. The bronchial glands may be enlarged and indurated. Usually, the disease progresses slowly. At times these cases are complicated with tuberculosis; a complication which appears to lengthen life by delaying the disintegration of the tubercles. Death occurs from exhaustion, or from some intercurrent attack of pleurisy, or bronchitis, or pneumonia, or even from hæmoptysis.

"(5) *Tubercular* phthisis, or pulmonary tuberculosis, is a destructive disease, attended by the growth and degeneration and disintegration of a lowly organized material called tubercle; which material is the local manifestation of that general unhealthy condition of the system known as scrofula."[1]

We shall now speak particularly of the general features of tubercular phthisis.

Tubercle, or tuberculous matter, is the specific product of a peculiar constitutional disease. It is deposited in distinct isolable masses, or is infiltrated into the tissues of many different organs; most frequently, however, it is found in the lungs, first in their apices, constituting pulmonary tuberculosis, or tubercular disease of the lungs, or phthisis, or consumption, these terms being synonymous. The morbid condition of system which gives rise to this production, wherever it may be deposited, is now usually known as tuberculosis, or tubercular disease: the tendency to it is often hereditary. Pulmonary tubercles are found in two varieties, or in forms intermediate between them—viz., as the gray or miliary, and the yellow tubercles. The minute structures of both are essentially similar. Of course, there has been a vast amount of speculation as to the mode of formation and nature of tubercle. The best explanation, and that to which many authorities—as Lebert, Ancell, and Dr. J. H. Bennett—subscribe, is that it consists of an exudation of the liquor sanguinis, presenting marked differences from the simple or inflammatory exudation on the one hand, and the cancerous exudation on the other. From its chemical analysis, it would appear to consist of animal matter—principally albumen—and certain earthy salts, chiefly the insoluble phosphate and carbonate of lime, and the soluble salts of soda.

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[1] "The Practice of Medicine." By T. H. Tanner, M.D. 6th edition.

In phthisis the tubercular deposit takes place in the areolar tissue between the air-cells, in the air-cells themselves, and in the smaller bronchial tubes communicating with them; wherever a speck of this matter is deposited from the blood, it continues to increase by constant addition. In its hard state it is called *crude tubercle.* After a time, inflammatory deposit or tubercle infiltration takes place in the pulmonary substance around the tubercular deposits, and the more chronic the disease the more marked does this become; adhesions form between the pleura costalis and pleura pulmonalis, the result of friction, suppuration then occurs, the tubercular matter softens, first in its centre and breaks down, and at length is gradually expelled through the bronchi, trachea, and mouth, leaving cavities or excavations behind, of various sizes. Sometimes these cavities close and heal; more frequently tubercular matter continues to be deposited on their sides and in other parts of the lungs, until these organs become diseased to an extent incompatible with life.

The *general symptoms* of tubercular phthisis are at first often slight and insidious, cough, debility, muco-purulent expectoration, acceleration of the pulse, dyspnœa, hæmoptysis, loss of flesh, hoarseness, a peculiar transparent appearance of the edge of the gums where they are reflected over the teeth, sweating, and diarrhœa. The disease ordinarily sets in with a short dry cough, which may continue some time without being aggravated, or without the supervention of any other symptom. Frequently there is hæmoptysis, which, recurring at variable intervals, gives the first intimation of the disease. The patient complains also of languor; slight exertion—ascending a hill or going up stairs—causes fatigue, hurries the breathing, and often gives rise to palpitation. When this state has lasted for some time, during which the cough and expectoration have been increasing, hectic fever appears. The debility becomes more marked; the countenance is frequently flushed; chilliness is complained of in the evening, while on awaking in the morning the body is found bathed in a profuse sweat; and there is loss of appetite, with thirst, &c. The patient now rapidly loses flesh; diarrhœa often sets in and increases the feebleness ; the lower extremities become œdematous ; and death soon ends the scene.

Some authors have divided phthisis into three stages. During the *first*—that in which tubercles become developed in the lungs—neither the local nor the general symptoms warrant us in announcing the presence of any other affection than severe catarrh ; if the tubercles be deposited, however, in considerable quantity, there will be flattening of the supra- and infra-clavicular regions, the sound on percussion will be dull, the act of expiration will be prolonged—from impairment of the elasticity of the lungs—the breathing will be harsh, and *bronchial respiration* and *bronchophony* will be heard. In the *second* stage, the tubercles increase both in number and size, so as to compress and obstruct the substance of the lung, and occasion marked depression of the supra- and infra-clavicular regions, whilst the dulness will be increased; large crepitation will be distinct, and in the sound lung puerile breathing. In the *third* stage, the tubercles become softened; they make an opening for themselves through some of the surrounding or involved bronchi, and being thus evacuated, they give rise to the formation of cavities; pieces of lung-tissue may be expectorated and detected by the microscope. Auscultation now elicits a peculiar sound, called *gurgling* or *humid crackle*, caused by the bubbling of air with the pus or mucous contained in the cavity. Gurgling, it must be remembered, may also arise from that rare disease, circumscribed abscess of the lungs, as well as from the mixture of air with liquid in a dilated bronchus affected with chronic inflammation. When the cavity contains no liquid, we hear *cavernous respiration;* if it be large, *amphoric resonance* and *pectoriloquy* will also be distinguishable. Notwithstanding the existence of one large or of numerous cavities, percussion almost invariably affords a dull sound, owing to the layer of lung forming the wall of the cavity being dense and solid.

Phthisis may be inherited or it may be acquired; it is not contagious. The left lung suffers more frequently than the right; and when tubercle is found in the lungs it is rarely absent from the organs. The apices and posterior parts of the upper lobes of the lungs are ordinarily the situations in which the deposit first takes place.

No period of life is exempt from this scourge; though it is rare in those under two or three years of age, and most common between twenty and thirty. Insufficient and bad food, impure air, confinement, deficiency of light, and immoderate indulgence of the sensual passions, may be regarded as frequent causes. Its ordinary duration is from six or nine months to two or three years.

GANGRENE OF THE LUNG.

This condition is characterized by the presence of sputa of a dirty gray or greenish color, and most offensive odor, the breath being likewise fetid. A patient may have gangrene of the lung, however, without stinking sputa or breath, but this is infinitely rare. The general symptoms are those of extreme prostration, a rapid feeble pulse, a typhoid condition, with delirium and the like. Gangrene of the lungs occurs in, it is said, those who are insane and who starve themselves to death, in certain states of blood poisoning, as in pyæmia, fevers, glanders, in the pneumonia of those who are much debilitated, and after pulmonary apoplexy, or the arrest of the circulation through a large artery by the pressure of tumors, such as hydatids or cancer.

The physical signs proper to the actual gangrene—viz., in addition to those which belong to the cause of the gangrene—are, dulness on percussion, various rhonchi, and then cavernous and bronchial breathing following the breaking up of the lung-tissue. It is important to recollect that in bronchitis and pneumonia the sputa *may* be fetid, but then the lung-substance is not disorganized in the same manner as in true gangrene.

PULMONARY APOPLEXY.

In this affection blood is extravasated into the air-cells or the tissue of the lung, which is then broken up more or less. If the blood coagulates, then there may be a well-defined circumscribed mass or masses in the lung-tissue; in other cases the blood infiltrates the tissues generally. The origin of the apoplexy is chiefly to be accounted for in two ways: blood may be poured out at once into the lung-tissue from a rupture of the adjacent vessels, especially where there is obstruction in the left side of the heart (particularly in mitral obstruction), and again in embolism; or blood poured out into the bronchial tubes, as in phthisis, may be rapidly and freely drawn into the air-cells in inspiration. Pulmonary hemorrhage also occurs in purpura and scurvy and other diseases which lead to a softening of the lung-tissue. The symptoms as regards the lungs are, hæmoptysis, quickened respiration, crepitant and subcrepitant rhonchus, and, according to the amount of extravasation, dulness, and suppression of the respiratory sound over the dull part—all suddenly developed.

ŒDEMA OF THE LUNG.

This condition is an infiltration of serum into the air-cells and the intercellular tissue, and it gives rise to dyspnœa. The lung or part of the lung affected is increased in bulk and weight, it pits on pressure, and gives exit on section to a frothy serum ; in simple œdema the tissue of the lung is otherwise unchanged. Œdema is secondary to mechanical obstruction as in heart disease, it occurs in Bright's disease, and as a part of general dropsy, sometimes in pneumonia and pulmonary congestion. The symptoms are dyspnœa, or often orthopnœa, dulness on both sides, diminution of resonance, weakness of respiratory murmur, with crepitant and subcrepitant râles, and the concomitance of Bright's disease, heart disease, &c.

CIRRHOSIS OF THE LUNG.

In some cases lymph is effused into the cellular tissue of the lung, of a similar kind, as regards its nature and the changes which it undergoes, to that which is seen in cirrhosis of the liver and kidney. Some authors regard the disease as an *interstitial pneumonitis.* The effused lymph contracts and obliterates air-cells and vessels, the bronchi dilating under the pressure of inspiration, and the force exerted by the contracting lymph ; the lung itself becoming heavy, solid, and tough, and smaller than usual, hence the shrinking of the chest on the affected side and the hypertrophy of the opposite lung, the heart being displaced towards the affected side. The disease may attack the whole or part of a lung. The symptoms are somewhat like those of chronic phthisis. There is cough, free expectoration, hæmoptysis occasionally, emaciation, and feverishness. The side of the affected lung contracts, its movements are lessened at the same time that the signs of solidification, bronchial breathing, increased vocal fremitus, &c., are present. The diagnosis requires to be made from chronic phthisis and pleurisy with retraction, and the general history of the case must mainly determine these points. *See fibroid phthisis*, p. 250.

CANCER OF THE LUNG.

This is a rare disease. When it occurs it is in those over fifty years of age, and generally secondary to cancer elsewhere. The encephaloid variety is the most common, scirrhus being rare and colloid practically unknown. Cancer may spring up in the lung itself, and is then generally of an infiltrating kind, or in the pleura, bronchial glands, or mediastinum. In cancer of the lung, the latter is increased in weight, but it may not be altered in size, or only slightly diminished, then there are no physical signs of the existence of the disease perhaps; only when the infiltration is marked is there dulness on percussion. Cough occurs and expectoration mixed with blood and mucus—if currant-jelly-like, it is characteristic; there is more or less dyspnœa, according to the amount of deposit and the extent of pressure exerted on the air-passages. The amount of vocal fremitus and resonance, as well as harshness of respiratory sounds, will be in direct proportion to the degree of patency of the bronchi. Hæmoptysis and gangrene may occur. Perhaps the pressure signs are the most important; not only may deglutition and breathing be interfered with, but the heart displaced, the voice altered, and even the pupil by irritation of the sympathetic, whilst œdema results from pressure on the cava. Pleurisy is often an accompaniment. The cachexia is perhaps not so well marked in cancer of the lung as in that of other organs. The diagnosis turns upon the general history of the case, the pressure signs, the hæmoptysis, the cachexia, and the sputa.

HYDATIDS OF THE LUNG.

These are rare. The cysts may be formed primarily in the lung, or may make their way thither from other parts, especially the liver. In the former case the symptoms are not marked at first, but presently, pain, cough, expectoration, hæmoptysis perhaps, and even coughing up of hydatid cysts occur; emaciation follows, with a condition like phthisis. If the primary seat of disease be the liver, circumscribed peritonitis or pleurisy occurs before the hydatids get into the lung. The diagnosis is made by a process of exclusion with the detection of a history of hydatid disease of the liver, or the discovery, in the expectoration, of the cysts or hooklets of the echinococci.

DILATATION OF THE BRONCHI.

This condition may be local or general; and globular, uniform, or irregular, as regards the individual bronchi. In the acute form of disease the tissue of the lung is slightly changed, as in dilatation in acute bronchitis; but in the chronic form of disease there is lung change incidental to the disease of which bronchial dilatation is only a part. The principle upon which dilatation is produced is this: a portion of lung becomes solidified, the pressure of the air in respiration is brought to bear upon this part, but it cannot expand, and the bronchi dilate instead. The act of coughing is all-powerful in helping out bronchial dilatation, which occurs in acute and chronic bronchitis, emphysema, pneumonia, phthisis, cirrhosis, and chronic pleurisy, with retraction of the side. The physical signs peculiar to the dilatation are theoretically, increased resonance on percussion, and amphoric or else bronchial breathing strongly marked, but if there be a large dilatation we have all the symptoms of a cavity. The history of the case determines the nature of the concomitant affection.

PERICARDITIS.

Inflammation of the external serous covering of the heart—pericarditis—frequently arises from cold, from mechanical injuries, from a contaminated state of the blood produced by renal disease, and from acute rheumatism.

The symptoms of this affection are, in the primary form of the disease, high fever; pain, often stabbing in character, referred to the region of the heart, often darting through to the left scapula, upwards to the left clavicle and shoulder, and down the arm, and over the heart—increased by decided pressure; palpitation, the motions of the heart being tumultuous, and perceptible at a distance from the patient in marked cases; frequency and at times irregularity of the pulse; hurried respiration; incapacity of lying on the left side; strong pulsation of the carotids; anxiety of countenance; and frequently noises in the ears, giddiness, and epistaxis. As the disease advances, there is extreme debility, cough, suffocative paroxysms, occasionally a tendency to syncope, and œdema of the face and extremities. These symptoms often vary much in different cases, according to the amount of lymph or fluid poured out, and its early, late, or non-absorption.

Secondary pericarditis is often insidious, the pain slight, and the general disturbance less marked than in the primary form of disease.

On practising auscultation, we shall find—in the earliest stages—increased intensity of the natural sounds ; if endocarditis coexists, as it so frequently does, a loud systolic *bellows-murmur* will also be heard, indicating fibrinous deposits in the texture as well as on the surface of the valves, from inflammation of the internal membrane of the heart—the endocardium. The chief sign of pericarditis is the friction-sound, and its special characters are fully described at p. 233. On applying the hand over the heart friction-fremitus may be felt. The pericardium may be covered by lymph and contain little fluid, or the fluid may be more or less copious, then the cardiac dulness increases upwards, downwards, and laterally, but it is pyramidal in outline ; its longest diameter being from above downwards, the narrowest part being upwards ; the dulness may extend up to and even beyond the second cartilage, and over to the right of the sternum, below on the right, and to the nipple on the left. When the two surfaces of the pericardium are separated by fluid, there is no friction heard, but friction is again detected when the fluid is being absorbed ; if the fluid does not become absorbed, we say that *hydro-pericardium* exists, which usually proves fatal.

ENDOCARDITIS.

Inflammation of the lining membrane of the cavities of the heart—endocarditis—occurs much more frequently in the left cavities than in the right, affecting only the tricuspid in the latter case. It attacks the valvular apparatus more strikingly than the general tract of the membrane. At the mitral valve, the insertions of the chordæ tendineæ, and at the aorta the parts between the corpora arantii and the free edge of the valves suffer most. The symptoms are those of fever at an early stage, then heart disturbance, a sense of oppression and uneasiness at the præcordial region; fever; small, feeble, and intermittent pulse; great anxiety; subsequently we have cold sweats; oppressive dyspnœa; jactitation; and syncope. When the inflammation is only of limited extent, or when it assumes a chronic form, the symptoms are much milder and more obscure. Locally the symptoms refer to an interference with the valves of the heart, and to detachment of portions of clot, and their circulation through the arteries.

If we apply the hand to the chest in simple endocarditis, the action of the heart will appear to be very violent; sometimes a vibratory thrill will be felt. Percussion often discovers a slightly augmented extent of dulness in the præcordial region. If we listen to the heart's action we shall detect a bellows-murmur, the most constant and characteristic of the phenomena of the endocarditis (see p. 234). Pieces of fibrin deposited on the roughened valves may be washed off and circulate in the arteries, and going to the brain produce hemiplegia, or to the liver and kidneys, embolia.

Valvular Diseases of the Heart.—In exploring the diseases of the valves of the heart, whether resulting from endocarditis, or from the formation upon them of warty excrescences, or from the tearing of their tissues, or from their conversion into bone, assistance may be derived from remembering—in addition to the physical signs pointed out in the preceding chapter—the following principal physiological or functional symptoms which they often present to greater or less extent:

1. Difficulty of breathing, varying from the slightest dyspnœa to the most severe orthopnœa; much increased on ascending a height or making any exertion.
2. Palpitation and irregular action of the heart, with certain sounds and murmurs discoverable by auscultation, &c.
3. Irregular pulse. In mitral disease the pulse is generally soft and irregular; in aortic regurgitation, hard, jerking, but regular and visible.
4. Congestion of the lungs; bronchitis; pneumonia; pulmonary hemorrhage, with or without pulmonary apoplexy; these symptoms are most urgent in mitral disease.
5. Hemorrhages from the nose, bronchial tubes, or mucous membrane of the stomach.
6. Œdema of the lower and sometimes of the upper extremities and face; hydrothorax; and ascites. Dropsy

is more common in disease of the right cavities of the heart than in affections of the left.

7. Cephalalgia, tinnitus aurium, vertigo, syncope, cerebral congestion, and cerebral hemorrhage, most urgent in aortic disease.

8. Broken rest, with startings during sleep, and frightful dreams.

9. Enlargement of the liver and spleen, with disorder of the digestive organs generally.

10. A peculiar appearance of the countenance, wherein the face is puffed, the cheeks flushed and of a purple hue, the lips congested and the eyes bright.

It should be remembered that a murmur may not be developed till the lymph deposited in the acute attack of endocarditis has had time to contract, and then to distort the valve flaps or the orifices.

As regards *affections of the heart generally*, the diagnosis will be assisted by attention to the following points, many of which are well laid down by Dr. Spillan.[1]

The *causes* which have occasioned an affection of the heart may throw some light on its nature; as when either of the parents have labored under some particular heart disease we shall have reason to fear that the offspring will be affected with the same disease. With respect to *age* and *sex*, the affections of the heart during the early periods of life are generally attributable to inflammation and to congenital lesions, whilst in the aged they are due to fatty degeneration of the muscular fibres, to ossification, or to pulmonary disease. In early life, and perhaps in women, the mitral valve and corresponding auriculo-ventricular orifice are most frequently diseased ; in advanced life, and in men, the aortic. Young girls, about the age of puberty, and anæmic women generally are especially liable to palpitation and other temporary symptoms of cardiac disease without any organic lesion.

With regard to *form* of body, it has been noticed that robust persons, if they lead a sedentary life and live freely, are liable to certain symptoms of heart disease, which, if allowed to continue, ultimately lead to hypertrophy. A person who has a large abdomen, or an abdominal tumor, or who overloads his stomach, and so causes the viscera to be pressed upwards—thus diminishing the size of the thorax, may experience many of the symptoms of disease of the heart, without any organic change really existing.

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[1] See Dr. Spillan's translation of Schill's "Pathological Semeiology," p. 93.

Occupation has some influence in giving rise to cardiac affections; persons who make great muscular exertions, or who carry heavy loads, being especially predisposed.

The manner in which cardiac affections first set in may often throw some light on the diagnosis. Thus, if the attack be sudden, an acute affection may be the source of the evil. If there be at first rupture or distension of muscles, followed by acute pains in the region of the heart, we may suspect that the fleshy fibres are affected. If a rheumatic inflammation precedes or accompanies the attack, the pericardium, or, less probably, the endocardium, or even both, will be the seat of the disease. Again, if the onset of the disease has been marked with slight symptoms, which have slowly and gradually increased, there is reason for apprehending the existence of some organic lesion, which will become more certain if the symptoms go on uninterruptedly, if they steadily increase in severity, and if they give rise to those general constitutional disturbances previously noticed.

Lastly, as regards the *seat* of the disease, the points of importance have been summarized in speaking of murmurs (see p. 235).

ATROPHY OF THE HEART.

There are two forms of atrophy of the heart: one in which the organ simply wastes, and dwindles in all its parts, ex., in exhausting diseases, cancer, phthisis, and the like; the other, in which the texture of the muscle suffers a sort of conversion into fat—becomes affected with fatty degeneration.

Fatty degeneration of the heart is a most interesting disease. It occurs in two forms—the one, in which there is excessive deposit of fat external to the heart, and the other, or the true disease, in which the fibres of the heart are degenerate and fatty. The latter form of disease may be conjoined to dilatation or hypertrophy, or occur with valve disease, with disease of the coronary arteries, and other changes in the heart, &c. Men after fifty years of age are most liable to it. It occurs either alone or in conjunction with fatty disease of the other organs, as the kidneys, liver, cornea, &c. Its *diagnosis* is beset with difficulties, and when existing alone it is frequently not suspected until after death, and after a microscopic examination of some of the muscular fibres of the heart. The most prominent symptoms are feeble action of the heart, and this is shown by weakness, slowness, and irregularity of the pulse—sometimes there is a very slow pulse—by symptoms of want of blood in the brain, such as repeated syncope, a feeling of nervous exhaustion, loss of tone, and by disordered respiration. There are peculiar attacks of disordered breathing—several hurried inspirations are taken in a fit of dyspnœa apparently, they become lessened, and at length apparently cease for a while, when the phenomena are repeated. Mr. Paget well remarks that "the principal characters which all these cases seem to present is, that they who labor under this disease are fit enough for all the ordinary events of calm and quiet life, but are wholly unable to resist the storm of a sickness, an accident, or an operation." In some cases what seem to be apoplectic fits occur, but there is no subsequent paralysis though distinct loss of consciousness is observed in the attack.

HYPERTROPHY OF THE HEART.

The heart is stated roughly to be about the same size as the closed fist; its ordinary weight is in males on an average 9½, in females 8½ ounces. The muscular walls of one or more of the cavities of the heart may become thickened without any diminution in the size of the chamber; this is called *simple hypertrophy*. Or, as most frequently happens, the walls may be thickened and the chamber become larger than natural: this is *eccentric* or *dilated hypertrophy*. On the other hand, the increase in thickness may be accompanied with diminution in the size of the cavity; this is known as *concentric hypertrophy*.

The *cause* of the hypertrophy is, as in all other muscular structures, overwork, the result usually of some obstruction either to the flow of blood through the heart or the great vessels, or to the free play of this organ, as occurs for instance in emphysema; the *symptoms* are palpitation, dyspnœa, difficulty of walking quickly, uneasiness and pain in the cardiac region, headache, and frequent attacks of vertigo. If we listen to the heart's movements we shall merely find the systolic sound less distinct than in health; but we shall also feel that the extent of the pulsation beyond the præcordial region, and especially the degree of impulse—the impulse is "heaving"—against the walls of the chest, are both much increased.

Recently Dr. Johnson has demonstrated the existence of hypertrophy in the coats of the minute arteries generally in Bright's diseases, and he believes that the obstruction resulting from this condition occasions hypertrophy of the heart. This is open to criticism.

DILATATION OF THE HEART.

The same cause which leads to hypertrophy tends to produce dilatation, which is also helped out by anything which tends to degeneration of the heart's structure—ex., fatty changes, carditis, &c., and occasions a loss of contractile power. The symptoms and signs are, increased dulness in the transverse direction, feebleness of impulse, lowering of the apex beat, which may be felt at the epigastrium. If the right ventricle be especially dilated, there is tricuspid regurgitation and its attendant ills. A dilated heart displaces the liver downwards.

CYANOSIS.

Cyanosis, morbus cæruleus, or blue disease, are terms applied to a condition characterized by blue or purplish discoloration of the skin, arising generally from some malformation of the heart, permitting direct communication between the right and left cavities.

The chief malformations are, permanence of the foramen ovale ; abnormal apertures in some part of the septum of the auricles or of the ventricles ; origin of the aorta and pulmonary artery from both ventricles simultaneously ; extreme contraction of the pulmonary artery ; or, lastly, continued patescence of the ductus arteriosus.

In addition to the discoloration of the skin, the patients who survive their birth suffer from coldness of the body, palpitation, fits of dyspnœa, syncope on the least excitement, and dropsical effusions.

ANGINA PECTORIS.

This disease is characterized by sudden and acute excruciating pain in the region of the heart, accompanied by pain radiating to the arm or through the chest, with sometimes, but not always, dyspnœa ; a sense of impending death, cold clammy perspiration, great anxiety of countenance, fear of the least movement, or sometimes of breathing. If death takes place it is by syncope ; the attacks, which are paroxysmal, vary in length, and the intervals of freedom gradually diminish. This disease, which is regarded as "neuralgia" by some, or "spasm" of the heart, is found in association with all kinds of organic heart disease, but the heart may be healthy. The most common pathological accompaniments are fatty heart, disease of the coronary arteries (calcification), and of the aortic orifice. Angina is very rare before the age of fifty ; it is seen in members of the upper classes. The prognosis is of the very gravest kind because of the possibility of sudden death.

FUNCTIONAL DISORDER OF THE HEART.

Under this term is included all those forms of perverted action of the heart as regards frequency of contraction and rhythm which are not due to organic disease. The chief symptom is palpitation. Intermittency is another.

Palpitation is common in nervous conditions—ex., hysteria, spinal irritation, uterine and ovarian excitement, sexual excess, masturbation, &c.; in certain altered blood states, as in anæmia and hemorrhage ; where the action of the heart is mechanically interfered with, as by a distended stomach, flatus in the colon, and lastly as the result of the action of certain special substances circulating in the blood, as nicotine, the active principle of green tea, &c.

The diagnosis is made by the paroxysmal character of the increased heart's action, and the absence of signs of organic disease.

EXOPHTHALMIC GOITRE.

In some cases of increased action of the heart, a remarkable enlargement of the thyroid body and prominence of the eyeballs has been observed, and to this triple condition the term exophthalmic goitre has been applied. It is known also as Graves's disease or Basedow's disease, from the two distinguished men who described it. When the disease is well marked, the staring prominent eyes are its most special feature ; the whites of the eyes are largely exposed, and the eyelids may not be able to close ;

vision is not disturbed, and there is no pain in the eyes. The thyroid is moderately enlarged; its arteries are increased in bulk. The heart is the seat of paroxysms of marked palpitation. The general condition is one of anæmia. Sometimes the eyes may not be prominent; sometimes the thyroid is not enlarged, but the cardiac perversion exists.

ANEURISM OF THE AORTA.

Three forms of aneurism used to be described: *true aneurism*, in which all the coats of the artery dilate and unite in forming the walls of the pouch; *false aneurism*, in which the inner and middle arterial tunics being ruptured, the walls are formed by the cellular coat and contiguous parts; and *mixed or consecutive false aneurism*, in which the three coats having at first dilated, the inner and middle ones subsequently rupture as the distension increases during the progress of the disease. There may be a pouching, or the vessel may be dilated as a whole, or the blood may find its way between the coats, then we have a dissecting aneurism.

Aneurism of the Thoracic Aorta is chiefly met with in the ascending portion, or in the arch. Its *general symptoms* are very obscure, partly in consequence of their similarity to those arising from disease of the heart. The symptoms are those of tumor at the outset over the line of the aorta. When the aneurismal tumor is large and pulsating, and rises out of the chest, producing protrusion or absorption of the sternum and ribs, then the diagnosis is altogether as easy as it was before difficult. When the sac presses upon the trachea, there will be dyspnœa; when on the recurrent laryngeal nerves, aphonia, and occasionally a mimicry of laryngitis; when on the œsophagus, dysphagia and symptoms of stricture; when on the large veins of the neck, there will be œdema of the face, neck, and head; when on the thoracic duct, inanition, and engorgement of the absorbent vessels and glands; and when on the spine, pain and paraplegia after a while, from absorption of the vertebræ. The pulse on one side may be lessened by pressure.

Aortic aneurism is sometimes accompanied by a bellows-sound, sometimes not. In false aneurism there is generally a murmur both with the entrance and exit of blood into the sac; or there may be one loud, prolonged, rasping bruit, from the passage of the blood over the roughened inner surface of the vessel. In true aneurism, or mere dilatation of a part of the wall of the artery, murmurs are seldom audible. A small but free opening from the canal of the artery into the aneurismal sac, and a roughened state of the arterial tunics, from degeneration or from atheromatous deposit, are, however, two conditions which will give rise to a bruit. In both forms, when a murmur exists, a peculiar thrilling or purring tremor will be felt on applying the hand over the sternum.

Aneurism of the Abdominal Aorta often gives rise to acute pain in the lumbar region, occasionally shooting into either hypochondrium, and downwards into the thighs and scrotum; constipation aggravates the pain. By careful examination, a tumor may generally be felt, which communicates a constant and powerful pulsation to the hand, and the tumor felt has an *expansile* motion; but it must not be forgotten that the pulsation of the aorta may be communicated to a cancer or other tumor seated over it, and aneurism be simulated. On applying the stethoscope, a short, loud, abrupt bellows-sound will be heard.

Aneurism of the Heart is said to occur in two forms; either there is simple dilatation of the wall of a ventricle, forming the improperly called *passive aneurism* of Corvisart, which is dilatation only; or a pouched fulness arises abruptly from the ventricle, constituting a tumor on the heart's surface, or projecting into its cavities; this is true aneurism. The sac often contains laminated coagula of blood, especially when its mouth is constricted.

The *symptoms* are uncertain and obscure. Death may result from rupture into the pericardium, or, if the pericardium be adherent to the heart—as it mostly is in these cases—into the pleura.

Aneurisms of the coronary arteries sometimes occur. We know of no signs on which the physician can rely for their detection.

CHAPTER IX.

THE PHYSICAL DIAGNOSIS OF DISEASES OF THE ABDOMEN.

THE organs contained in the abdominal cavity can hardly be considered of the same vital importance as the brain, lungs, or heart; still the correct performance of the functions of the abdominal viscera is most important to the welfare of the individual, and the careful study of their diseases is incumbent on every practitioner, since they cause much suffering, and ultimately often destroy life.

Regions of the Abdomen.—If a horizontal line be drawn around the body, touching the extremity of the ensiform cartilage, this will form the superior boundary of the abdomen; draw another such line on a level with the cartilages of the last false ribs, and a third on a level with the crests of the ilia; we shall thus have three horizontal zones. These are to be subdivided each into three regions by drawing two vertical lines—one on either side—from the middle of Poupart's ligament perpendicularly upwards. The three central regions thus formed are named—from above downwards—the epigastric, the umbilical, and the hypogastric; on either side of the first are the right and left hypochondria; of the second, the right and left iliac; of the third or lowermost zone, the right and left inguinal.

Thus we have the epigastric—and right and left hypochondriac regions.

The umbilical—and right and left iliac.

The hypogastric—and right and left inguinal.

The epigastric contains the central part of the stomach and its pyloric end, the left lobe of the liver, the head of the pancreas, and the hepatic vessels, the cœliac axis, the semilunar ganglia, part of the cava, aorta, and thoracic duct over the spine. The right hypochondria, the right lobe of the liver, gall bladder, the commencement of the duodenum, the colon, the upper part of the right kidney, and the right capsules. The left hypochondria, the cardiac end of the stomach, with the spleen, part of the colon, the pancreas in part, the upper part of the left kidney, and the left capsule.

In the umbilical region are the mesentery and omentum, part of the duodenum, colon, and jejunum. In the right iliac region, the cæcum, with the ascending colon and the terminating ileum. In the left iliac region, the sigmoid flexure, and the descending colon. The lower part of the kidneys are deep in the upper part of the iliac region. In the hypogastric region are the bladder, small intestine, and the first part of the rectum ; the uterus in the female. Posteriorly the kidneys are situate in the lumbar and dorsal regions, from the level of the eleventh rib in fact, to near the crest of the ilium. The right kidney is rather the lower.

Modes of Physical Examination.—Five methods of physical examination are resorted to in the diagnosis of diseases of the abdomen—viz.: 1. *Inspection*, by which much valuable knowledge is obtained as to the shape, the positive and relative size, and the situation and movements of the abdominal viscera; 2. *Mensuration*, by which we confirm the evidence obtained by inspection; 3. *Palpation*, by which the size, situation, consistence, and tenderness of the different organs may be estimated and the presence of tumors when they exist; 4. *Percussion*, which often affords most important information, teaching us the situation of the intestines, and whether the parts beneath are hollow and filled with air, or whether there is fluid in the peritoneum, or whether there are any solid tumors; and 5. *Auscultation*, which is of especial value in the determination of pregnancy, of aneurisms of the abdominal aorta, and of tumors generally.

1. INSPECTION.

In examining the abdomen by the sense of sight, it is necessary, in the majority of cases, that it be uncovered and exposed to a good light, which may be carefully done without any offence to the patient's delicacy. The person to be examined may be in the erect or recumbent posture, with the arms hanging loosely by the side. When the abdominal walls and viscera are healthy, the general form of the abdomen is gently convex, both sides being symmetrical, and presenting here and there slight rounded projections and depressions. Healthy children have big bellies naturally. Partial abdominal enlargement will be manifested by unnatural fulness or bulging of any part of the abdominal parietes, the situation depending upon the cause: in general enlargement, the whole abdomen will bulge forwards, to a slight degree, when the enlargement is due to a general increase in the thickness of the parietes of the abdomen; more so when the abdominal organs are increased in bulk; and most of all when there is an accumulation of gaseous, liquid, or solid matters within the intestines, or within the cavity of the peritoneum. The abdomen, when enlarged by flatus, varies much in size at different times. Feculent accumulations take place mostly in the large intestines, and in the lower part of the ileum, causing distension of the colon and cæcum, manifested by irregular prominence in the right iliac, both hypochondriac, and left iliac regions. Disease of the liver gives rise to enlargement of the right hypochondriac and epigastric regions; while enlargement of the spleen produces a projection of the lower left ribs at the side, and a tumor in the left hypochondrium. Tubercular disease of the mesenteric glands is rarely accompanied by enlargement of the whole abdomen, and by deviations from its natural form and symmetry. In ascites, the smooth roundness of the abdominal swelling is peculiar, so that when the fluid is abundant the abdominal cavity is expanded into a large, smooth, and almost polished globe; while in pregnancy and in encysted ovarian dropsy the tumors can be traced deeply into the pelvis; and in ovarian disease, with enlargement, the latter is most marked on one side at first.

2. MENSURATION.

In measuring the abdomen, a common tape-measure will be found the most useful. The measurements are usually made at the margin of the lower ribs and the umbilicus, and when the abdomen is partially distended at and around the most prominent region.

3. PALPATION.

For accurate palpation, the patient should be on the back with the knees drawn up and the shoulders raised, the hand should be applied directly to the surface, using more or less pressure as we wish to determine the condition of the walls or of the deep-seated viscera, and according to the existence or non-existence of tenderness;

occasionally the whole of the palmar surface of the hand should be used, occasionally only the tips of the fingers, which are very sensitive. In health the abdomen is generally soft, and the walls are moderately elastic in each region. Tumors are discovered by their resistance to pressure, by their hard feel to the touch, and by the contrast which the parts occupied by them present to the healthy regions. Care must be taken not to mistake—as is often done—the contraction of the central portions of the recti muscles for ovarian and other tumors. This error may be avoided by keeping the flat hand firmly and steadily applied, while the patient's attention is attracted to other matters, when the muscles will be found to relax, or so much to vary their degree of tension as to show the cause of the hardness. The right rectus is often more tense than the left, especially if there be any tenderness of the liver. Sir Wm. Jenner rightly remarks in his admirable lectures on abdominal tumors, that the first thing to be done in diagnosing a tumor is to try and see whether the hand can be got between it and the pelvis—if so, it is an extra-pelvic one. The examination of the rectum and vagina will aid, if necessary, in deciding this point. Tumors of various kinds, mesenteric, aneurismal (which have an expansile throb), and others, may be felt by pressing deeply and rolling the hand to and fro into the belly, getting the fingers deeper at each expiration.

The character and influence of respiration in and on abdominal diseases must be specially noticed. The abdominal muscles are more or less completely quiescent in painful affections—ex., peritonitis; and in great distension the respiration is thoracic; but it is abdominal chiefly in pleurisy. The liver and spleen descend and ascend with in- and ex-piration; the kidneys but slightly. Now, aneurisms, tumors in the colon, mesentery, stomach, pancreas, or mesenteric glands, are not influenced by respiration. This sign is important in diagnosis, and is appreciated by palpation. In health, the liver and spleen are not to be felt below the ribs; the kidneys, when enlarged, are detected by pressing the tips of the fingers of the hand deeply into the lumbar region behind, near the spine, and then pressing the palmar aspect of the fingers of the other hand from before backwards, deeply and repeatedly during expiration. This point will be noticed again in speaking of renal diseases. In typhoid fever, by pressing the fingers placed flat over the iliac fossa sharply and pretty deeply into the abdomen, we feel a gurgling sensation; and in inflammation of the cæcum or accumulation in it, we feel distinct swelling. Palpation will also detect abscesses in the liver, distended gall bladder, cancerous deposit in the liver, splenic enlargement, accumulations of fecal matter, strictures per rectum, and many other things, to be referred to presently.

4. PERCUSSION.

In the diagnosis of abdominal diseases, mediate percussion is for the most part employed, the middle finger of the left hand forming an excellent pleximeter. Over the region of the liver the sound elicited is dull: over the stomach, when empty, slightly hollow; or when filled with gas, tympanitic: over the colon, when distended with air, resonant; when loaded with fæces, dull: while over the small intestines there is generally resonance. Over all the intestines a sense of elasticity is imparted to the percussing fingers. When the liver is increased in size, or when the spleen or the kidneys are enlarged, or when any solid tumor occupies the peritoneal cavity, there will be dulness on percussion in proportion to the extent of the solid matter. When, owing to perforation of the intestines, there is air in the peritoneum, the sound on percussion will be tympanitic, while the elasticity of the abdomen will be increased; when fluid or fecal matter has been effused, there will be dulness. There is one important sign in reference to ascites; if the patient is turned completely on one side, and the uppermost side is percussed, there will be a tympanitic sound, because the fluid will gravitate to the dependent part and the intestines will rise to the part percussed.

5. AUSCULTATION.

Auscultation of the Abdomen in Health and Disease.—The audible movements which occur within the abdomen in health are two: 1. The movements of alimentary or secreted matters, as gas, within the digestive tube, either by the spontaneous action of the canal itself, or as the result of manipulation; and 2, the movement of the blood in the vessels.

The pulsations of the aorta are occasionally heard during health in spare subjects; they disappear opposite the division of the vessel into the iliac arteries.

In disease these sounds are merely modified as regards their clearness and extent. When the surfaces of the peritoneum are roughened by inflammation, a *friction-murmur* may often be detected ; this sound is often audible in cases where friction-vibration cannot be felt.

Auscultation of the Abdomen during Pregnancy furnishes us with two very important signs—one derived from the uterus, the other from its contents. To detect them the patient should lie on her back with her shoulders raised, and the legs drawn up, in order to relax the abdominal integuments. *The uterine murmur*, known as the placental murmur or uterine soufflet, has its origin probably in the bloodvessels of the uterus, since a similar murmur is often heard in large fibrous tumors of the uterus. The character of the sound is that of a rushing, blowing murmur, synchronous with the maternal pulse, unaccompanied by any impulse, and requiring careful examination for its detection. It is generally first heard towards the end of the fourth calendar month, though it has been detected as early as the tenth week; it is frequently audible over the whole of the uterus, but is usually most developed over one or both inguinal regions. Its presence affords no evidence as to the life or death of the fœtus.

The pulsations of the fœtal heart afford a double sound somewhat resembling the ticking of a watch, varying in frequency from 120 to 160 in a minute, and having no relation with the pulse of the mother. The pulsations are best detected between the umbilicus and the anterior superior spinous process of the ilium, on either side, but most frequently to the left; they are rarely audible before the end of the fifth month of pregnancy, and they become more distinct as gestation advances. When discovered they prove a certain sign of the presence of a live fœtus.

Occasionally *the movements of the fœtus* can be detected both by palpation and auscultation, about the time that the fœtal heart is heard; and, according to some, "*the funic souffle*," weaker than the uterine murmur and synchronous with the fœtal heart, may sometimes be detected by the ear.

CHAPTER X.

GENERAL REMARKS ON THE DIAGNOSIS OF ABDOMINAL DISEASES.

It will only be necessary to give the main features and diagnostic marks of the more important diseases.

Abnormal Pulsations.—The pulsatory movements of the abdominal aorta are generally lost to the touch, although they may become evident both to the sense of touch and of sight when the parietes are wasted and the movements violent, as in anæmia, or in disease of the coats of the vessel—ex., aneurism, or when a tumor or cancerous mass lies directly over the artery. The aortic pulsations are usually best seen at the epigastrium, and sometimes at the umbilicus; on applying the hand, a jerking, quick, strong forward impulse is felt; while auscultation often discovers a bellows-murmur, especially if anæmia coexists. The pulsation in aneurism is peculiarly *expansile*, but it is merely an upheaving in that communicated to a tumor over the aorta.

PERITONEAL AFFECTIONS.

Ascites, or Dropsy of the Peritoneum, is an accumulation of serosity in the peritoneal cavity. The extent of the abdominal enlargement will of course depend upon the quantity of liquid present; if the fluid be in moderate amount, as the patient lies on the back the front of the belly may be flat and the sides somewhat bulged out; when in large amount the whole belly is distended, the navel flattened out, and fluctuation will generally be distinct; there will be in the less severe forms of disease resonance over the higher parts of the belly on percussion, owing to the floating of the intestines, thus prominently distinguishing ascites from ovarian dropsy; but the distension *may* be so great that the breadth of the mesentery is insufficient to allow the intestines to reach the surface of the fluid; dulness will then, of course, result. The percussion-note will vary with a change in the position of the patient. If he lie on his back the flanks give a dull sound: turn the patient on one side, and the uppermost one will be resonant, because the intestines rise to the surface, and the fluid gravitates to the dependent part. So in sitting, the lower part of the belly will be dull, the upper resonant, on percussion. Ovarian dropsy simulates ascites. In both diseases there will be dyspnœa, which will be urgent in proportion to the distension. In ascites the enlargement will be uniform, the belly flat in front at the outset, and the most dependent part (flank) will be dull, the dulness changing by alteration of position. In ovarian dropsy the belly is "globular," the enlargement is "one-sided" oftentimes, but the flanks are not full nor bulged.

Ascites is caused by general and local conditions; mostly by some cause which interferes mechanically with the circulation of blood through the abdominal vessels. Ascites may be a part of the general dropsy of Bright's disease, of that which follows scarlet fever, and again of that which is connected with heart disease; or it may have a local origin, as in peritonitis, from pressure on the vena cava by tumors, and disease of the liver with portal obstruction, as cirrhosis, cancer, hydatids. In the vast majority of cases it is due to cirrhosis of the liver.

Peritonitis, or Inflammation of the Peritoneum.—There are two forms, acute and chronic. It was formerly supposed that the disease was often idiopathic, but we now know that it is almost universally secondary to some "accident,"—ex., pregnancy, the escape of fluid from the abdominal organs or intestines into the peritoneal cavity by rupture or perforation, or from tumors and cysts. The acute form commences with rigors, then follow tenderness of the belly and pain, the pain, which is generally very severe, soon spreads over the whole abdomen, and is aggravated by any movement which calls the abdominal muscles into action, or by pressure—even the weight of the bedclothes being insupportable: the patient consequently lies quiet on his back, with his knees bent, and legs drawn up, and the abdomen distended and tympanitic. On careful examination, friction will often be heard, which has been likened to a gentle vibration under the fingers, or to a sensation of creaking, or grating, or crepitus. The abdomen is tense, hot, and frequently tympanitic; the bowels are constipated; there is often nausea, hiccough, and vomiting, the contents of the stomach coming up easily without effort; the skin is hot and dry; the pulse rapid and weak; the respirations hurried; the tongue furred; and the countenance is pinched and expressive of suffering and great anxiety. After a time the belly ceases to be tympanitic, but remains somewhat enlarged from the effusion of serum, being dull at the depending parts. When a fatal termination is approaching, the abdomen often becomes much distended, the pulse very quick and weak, the countenance ghastly, and death occurs from exhaustion.

Chronic peritonitis may be the result of an acute attack; generally it is caused by the deposit of tubercle, and much more rarely cancer. It is sometimes seen in Bright's disease, and localized to particular spots from the friction of tumors—splenic, hepatic, &c.—against the peritoneum. The symptoms are, pyrexia, wasting, and then the patients become hectic; locally there is pain increased by movement, induration when the disease is tubercular, and induration with fluctuation when it is cancerous. There may be diarrhœa, especially if the tubercle involve the intestines, or there may be constipation. There may be no vomiting. If the peritonitis be tubercular, the signs of tubercles will be present in the lungs.

INTESTINAL AFFECTIONS.

Obstruction of the Bowels is a disorder the diagnosis of which will be much facilitated by the careful practice of percussion, aided by palpation. This fearful accident—so to speak—may arise from several conditions, which we shall therefore consider on account of the great importance of the subject, premising that it may occur at any part of the bowels, from the duodenum to the rectum, and that when there is obstruction with fecal vomiting the disease is called *ileus*. *Strangulated hernia* is perhaps the most frequent cause of obstruction; consequently, in every case of obstinate constipation with sickness, the practitioner should make a careful examination of those parts of the abdomen, thigh, hip, and, in women, of the vagina, at which the intestine may descend. *Intestinal concretions* or *calculi* will also produce obstruction, and so will *polypi* formed in the gut, or foreign bodies escaping from the gall-bladder into the intestines, or swallowed. *Intussusception*, which consists of a slipping of a superior portion of the intestinal tube into an inferior, will also give rise to it. A part of the bowel may become strangulated by *preternatural bands*, or loops, the result perhaps of previous peritonitis, or by *elongations of the peritoneum.* Sir T. Watson says he has twice seen the appendix vermiformis prove the cause of fatal internal hernia. In one case, the free end of the appendix became adherent to the mesocolon, forming a loop, through which a portion of the gut passed and became constricted. In the other instance the appendix was literally tied round a piece of the intestine. In a case which we saw at King's College Hospital, a diverticulum from the small intestines was connected with the abdominal parietes close to the umbilicus, forming a ring, through which part of the ileum had passed and become strangulated. A part of the bowel may likewise become *strictured*, either from simple thickening of its coats, the result of ulceration, or from malignant disease, or by being *twisted*, or *the uterus may become retroflexed*, or *retroverted*, and by pressing upon the rectum materially diminish its calibre; and lastly, *the muscular fibres of the intestine may become paralyzed* from over- and long-continued distension, just as sometimes happens in the case of the urinary bladder.

The chronic form of bowel obstruction may result from habitual constipation, chronic peritonitis, tumors gradually pressing on the bowel, stricture the result of ulceration in the bowels, and cancer in the gut.

The principal symptoms of obstruction are, constant vomiting, which is at first simple—consisting of the contents of the stomach, and mucus, but which in a few days becomes stercoraceous or fecal; pain varying in degree, often very severe; great mental depression; and the pathognomonic symptom—constipation. The physical signs are such as indicate a state of emptiness below the seat of obstruction, and of distension above it. When the small intestines are greatly distended their convolutions are often traceable, and they may be felt by the hand to roll about with loud borborygmi; at the same time the abdominal enlargement and the distended small intestines obscure the resonant sound given out by the colon when empty. When the obstruction is seated only a little above the cæcum, this part may form a large dilated tumor in the right iliac region. When in the colon or rectum, assistance may often be derived from introducing the finger; or, if the obstruction be higher than the finger can reach, by using an elastic rectum-tube, or by injecting warm water, and observing how much can be thrown up. The lower the obstruction is situated the less urgent will be the vomiting; if, for instance, it is in the duodenum, the vomiting will be incessant from the beginning; if in the colon, it may be absent for some time. It might be thought that the ileo-cæcal valve would prevent the return of the contents of the colon into the ileum; the preliminary dilatation, however, renders this valve quite patulous. When urine is freely secreted, the obstruction cannot be very high up.

Colic really means a painful spasmodic affection of the colon, but it is generally used to signify any pain occurring in paroxysms, and being in itself of a severe constricting or griping character. Hence we have nephritic and hepatic colic, as the result of the passage of calculi. Intestinal colic is therefore spasmodic paroxysmal pain occurring in the intestines. The symptoms are griping felt at the pit of the stomach, which makes the patient bend forward, and even throw himself upon his face, and twist about in various directions, so intense is the pain; the umbilicus is often retracted, perhaps tender; the bowels may be confined, or there may be expulsion of fecal masses or wind with relief. The absence of the symptoms of fever and local inflammation exclude enteritis, peritonitis, and the like. Intestinal obstruction may exist, but its absence is soon determined by manual examination and the action of aperients. Then the cause will be found to be the taking of some indigestible substance, the existence of marked flatulence or constipation, or a "bilious" attack. There is one form of colic, however, that deserves special notice. It is—

Lead colic, which presents the ordinary symptoms of colic with constipation, coexisting weakness, or actual palsy of the extensor muscles of the forearm—the occupation of the attacked often bringing him in contact with lead compounds—together with the presence of a blue line along the gums, which is pathognomonic of the impregnation of the system with lead. The source of the lead *may* be adulterated snuff, potable liquids kept in leaden vessels, &c.

STOMACH DISEASES.

Dyspepsia means literally difficult digestion, and it is unnecessary to say more than that the symptoms are a sense of weight and distension at the epigastrium after taking food, eructations, a bad taste in the mouth, headache, perhaps nausea, but not often vomiting, heartburn, a foul tongue, palpitation, restless nights, tired feeling especially on waking, drowsiness, and irregular bowels. There is no tenderness on pressure, and no fever. Dyspepsia in the child gives rise to more disturbance; indeed it is nothing more or less in most cases than the "*gastric remittent fever.*" The stomach is more irritated, there is distinct fever, pale stools, and remissions of fever perhaps on alternate days. The form of disease in adults in which the symptoms of stomach irritation are marked is designated *irritative dyspepsia;* the ordinary signs of dyspepsia are well marked, but digestion is positively painful, the gastric region is tender, there is vomiting, and a sense of heat at the epigastrium, febrile disturbance, a small and red glazed tongue, the urine is loaded with urates and scanty, the pulse high, and the temper irritable. Where the symptoms of dyspepsia are present in anæmic subjects, and there is no irritative symptom present, but a pale tongue, languid circulation, flatulence, a sense of emptiness, free secretion of pale urine, and general debility, with a weak pulse, we have *atonic dyspepsia.* In *nervous dyspepsia* the ordinary symptoms of difficult digestion are present, but pain is a marked symptom.

When the pain is very severe and paroxysmal, we have *gastralgia* or gastric colic. Space does not permit of a fuller notice of these affections.

Gastritis or inflammation of the stomach is very rarely idiopathic, but almost invariably the result of the taking of irritant poisons, drinking boiling water, or the metastasis of gout. The symptoms are uneasiness, followed by the occurrence of acute pain at the epigastrium, increased by pressure, and even swallowing, with a burning sensation at the same spot; vomiting, which augments the pain (and respiration does the same), the vomited matters consisting of bile and mucus, or mucus streaked with bile; intense thirst, red dry tongue, a quick hard pulse, great uneasiness, fever, restlessness, hurried respiration, and, if the case terminate fatally, collapse before death. The severer form of irritative dyspepsia has been dignified by the term subacute or chronic gastritis.

Pyrosis or water-brash is the term given to that condition in which a large quantity of sour fluid is poured out into the stomach and is brought up without effort into the mouth. The symptoms preceding the discharge, which often takes place when the stomach is empty, being a sense of heat and burning at the pit of the stomach. The pain is relieved by the discharge.

Gastric Ulcer.—There are two varieties: the one which eats deeply called the *perforating*, the other the *chronic* ulcer. The former is seen in the pyloric half of the stomach near the smaller curvature, and on the anterior surface; the latter is found near the pylorus, at the posterior aspect of the stomach. The former generally runs a more rapid course, and perforation of the stomach is common in it. As to symptoms, these may be slight, if the ulcer is so situated that the food does not come in contact with it. Generally there is pain of a burning, or gnawing, or sickening nature, referred to one particular spot—to the right of the epigastrium generally—coming on after taking food, and relieved when by the act of vomiting the stomach is emptied. There is also pain felt through and in the back on a level with the ninth or tenth dorsal vertebra. The epigastrium is tender, sometimes the pain is intense. Vomiting is a constant symptom, and it occurs mostly just after taking food; the ejecta consist of food, mucus, blood, or stuff like coffee-grounds (altered blood), and fluid. Hæmatemesis, profuse or slight, often occurs, or dark clots may be brought up. Dark blood is also passed per rectum. Ulcer is a disease of early life (fifteen to thirty), and of females especially; it often occurs in connection with amenorrhœa, and it leads to sad emaciation. There is no tumor formed in connection with gastric ulcer. The non-perforating form may last for years.

Cancer of the Stomach.—In this disease the pylorus is mostly affected, and by the scirrhous variety. The cardiac orifice or the curvatures may be also attacked, and by either of the varieties of cancer. The symptoms in the early stage are those of dyspepsia, nothing more; but the pain becomes by-and-by more lancinating and constant—there may be occasional vomiting—then, if the pylorus is affected, signs of pyloric obstruction come on. Hæmatemesis is common. A tumor may presently be felt at the epigastrium, and the cancerous cachexia with emaciation is then well marked; cancerous elements may be detected in the vomit, which is often grumous. The disease runs its course in about two years. If the cardia is affected the symptoms are those of stricture of the œsophagus low down. Gastric cancer is rare before forty.

Dilatation of the Stomach.—This is secondary to obstruction caused by cancer, by the healing of ulcers, or fibroid thickening at the pylorus. The symptoms are occasional vomiting of badly-digested food and a large amount of yeasty-looking matter which contains *torulæ* and *sarcinæ* in abundance. There is a prominence at the epigastrium very resonant; in some cases the outline of the stomach may be made out through the abdominal walls; the appetite is often good, much is taken but little is assimilated, hence the body is emaciated.

LIVER DISEASES.

Position in Health.—By percussion we ascertain that the upper border of the liver in health is about two fingers' breadth or less below the right nipple, and its lower border a finger's breadth beyond the ribs below in front. The organ extends to the left in the epigastric region, about three inches from the middle line, and to about midway between the sternum and umbilicus; on the extreme right the liver stretches down to the level of the tenth interspace.

Remarks on Displacement.—The liver may be lowered by constriction of the chest, as in tight lacing or rickets, by fluid in the pleura or pericardium, by marked emphysema of the lungs, by a large and dilated heart, and by tumors in the chest. Displacement downwards must not be mistaken for enlargement. In a healthy condition the lower edge of the liver cannot be made out by palpation; in enlargement it may be felt by pressing the finger from below upwards deeply into the abdomen. below the spot where resistance is felt, so as to get under the liver edge.

Enlargement of the Liver.—Sir William Jenner's[1] remarks on this point are admirable. "When the liver is enlarged, you determine by percussion its upper limit; by the sense of resistance on percussion of the chest-walls, how closely it lies in contact with them; by palpation, if the organ be firmer than natural; and by percussion, if its consistence be natural at its lower border.

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[1] British Medical Journal, Jan. 2, 1869.

At the same time that you are defining the lower border by palpation, you appreciate the degree of resistance that the liver offers, how hard and how elastic it is; at the same time you note whether the margin is rounded or sharp, even or nodular; having fixed these points in regard of the margin of the organ, you pass your hand over so much of the upper surface as lies below the margin of the thorax, and note its characters, especially observing its hardness, and if it be smooth or nodular. There is, in reference to this last point, a source of fallacy, against which be on your guard. Some portion of the abdominal muscles lie over the liver, and the little irregularities of the muscles may be mistaken for irregularities of the surface of the liver."

Congestion of the Liver may be active or passive. It generally follows some disease of the heart or lungs which obstructs the circulation, but it also occurs from high living, malarious influences in hot climates, the too free use of alcohol, and functional disorder of the liver itself. The symptoms are a sense of weight and fulness over the liver, nausea perhaps, foul tongue, slight jaundice, torpor of the bowels, and detectable enlargement of the liver.

Acute Inflammation of the Liver, which occurs in hot climates, is signalized by pain, more or less severe, in the region of the liver, increased on pressure, deep inspiration or cough; inability to lie on the left side; a yellow tinge of the conjunctiva, sometimes jaundice; dyspnœa; cough; vomiting; and hiccough. When the pain is of a sharp, lancinating character, it is supposed to indicate inflammation of the serous covering of the gland; when dull and tensive, the parenchyma is the part affected; when the convex surface of the organ is the seat of the inflammation, the chest symptoms will predominate; when the concave, the stomach symptoms will be the most marked. This disease often ends in abscess.

Abscess of the Liver.—Abscesses of the liver sometimes attain a great size, and, in extreme cases, may contain several pints of pus. The right lobe is the chief seat of abscess. Fluctuation will be perceptible, not only over the region of the liver, where also a tumor may be felt and a bulging seen. The abscess may burst into the peritoneum, and give rise to fatal peritonitis; most frequently, however, when the matter gets near the surface of the gland, adhesive inflammation is set up in the portion of peritoneum immediately above it, and lymph is poured out, which glues the organ to adjacent parts—to the abdominal parietes, the diaphragm, stomach, or some part of the intestines; the pus is then discharged externally, or into the lung or pleura, or stomach, &c.

Cirrhosis of the Liver, "Hobnail Liver."—This is the result of chronic inflammatory action followed by the deposit of lymph in the midst of the areolar tissue which runs throughout the portal canals and interlobular spaces, which lymph subsequently contracts and produces atrophy of the liver structure, and general condensation of the liver as a whole; the final stage being the occurrence of ascites from obstruction to the portal circulation. The cause of the disease is mostly the free use of ardent spirits. The symptoms are those of hepatic congestion at the outset, with loss of appetite, abdominal distension, and constipation. Soon the liver becomes enlarged, and offers more resistance than usual, especially at its edge, if this can be felt. At the same time a peculiar sallowness of the complexion, depression of spirits, and loss of flesh are observed, and ascites commences; there may be hæmatemesis, marked jaundice, or febrile disturbance. The liver is now found to be smaller than usual by percussion, though it may be generally lower, and it is also felt to be indurated. These symptoms increase, and the patient dies within a year or so. The kidneys are often affected similarly to the liver. The spleen is sometimes enlarged. The disease is generally seen in those beyond the middle period of life.

Hydatid Disease of the Liver.—This is characterized by the presence of one or more cysts developed in the substance of the liver slowly and painlessly. It is seen in persons between the ages of thirty and forty, and in both sexes. Until the tumor becomes large and comes to the surface, there is nothing by which its presence can be diagnosed. In a well-marked case, we have a tense, elastic, globular, and painless prominence in the liver region, which has slowly formed without any constitutional disturbance or cachexia. There may be pressure signs, if the cyst is deeply seated—ex., ascites, and there may be jaundice, but these conditions are rare. These tumors may come forward or burst into the peritoneal cavity, or make their way to lung or pleura. Fluctuation may sometimes be plainly felt. The cysts are the habitation of the echinococcus.

Acute Yellow Atrophy of the Liver.—This is a very acute, sudden, and rapidly fatal disease, in which the liver diminishes quickly in size, and the bile is completely suppressed, the result being the poisoning of the system, followed by delirium, or convulsions, then coma and death. The prodromata are not special—a sense of illness, depression of spirits, a sallow look, pain over the liver, disordered bowels, and perhaps vomiting, then suddenly the patient is prostrated, hiccough comes on, marked delirium and coma follow, with jaundice, tenderness and diminution in the size of the liver—the structure of which is completely altered, the liver-cells disappearing—enlargement of the spleen, intestinal hemorrhage, petechial blotches, absence of bile from the stools, and the presence of tyrosine and leucine in the urine. The disease may simulate typhus and pyæmia, but there is no mulberry eruption present, and jaundice and those special conditions which occasion pyæmia are absent.

Cancer of the Liver.—All varieties of cancer are found in the liver as primary and secondary diseases. The symptoms are enlargement of the liver, which may be distinctly felt, with nodules on the surface having a depression at their centres ; there is pain if the peritoneum is irritated ; the cachexia is well marked, and if the cancer press on the gall-ducts or the veins of the liver, we have respectively jaundice (which is permanent), and ascites—often very extensive. Together with these symptoms there is marked emaciation.

Syphilitic Disease of the Liver produces symptoms something like cirrhosis. Generally speaking there are masses of plastic matter deposited in the liver (tumores gummati), and these may be felt through the abdominal walls. There are no pressure signs. The diagnosis is made by the concomitants, the syphilitic history, the age, the cachexia, the presence of tertiary symptoms elsewhere.

Fatty and Waxy Livers.—These two conditions, the first occurring in drunkards, the tuberculous, and the cancerous, the latter mainly in rickety subjects, but also after free suppuration, disease of bone, and other exhausting diseases of a prolonged duration, are both accompanied by enlargement of the liver, without the symptoms of obstructed portal circulation. In the fatty liver there is a superabundance of fat. In the waxy, or albuminoid, or lardaceous liver, there is infiltration of the organ with a transparent or slightly opaque material, which turns blue by iodine. Its nature is at present unknown. It is not fatty. In both diseases the kidneys may be affected from the same general cause, and then albumen appears in the urine. The symptoms of fatty liver are hepatic enlargement, with deficient biliary secretion, and pale stools, diarrhœa, and constipation alternately ; a soft-feeling liver, anæmia, and a skin soft and greasy—occurring in an intemperate or phthisical man. The waxy liver is known by the fact of its marked enlargement, the albumen in the urine, and the cachexia which is present.

Gall-stones.—It is only necessary to describe the symptoms to which they give rise. Gall-stones produce no inconvenience or discomfort, as the rule, until they get into the cystic or the common duct. When this is about to take place, there is some uneasiness about the liver. As the gall-stone gets into the duct, spasmodic contraction of the latter occurs, giving rise to intensely sharp pain, generally referred to the gall-bladder, and somewhat relieved by pressure, but radiating to the chest, shoulder, and other parts ; in addition there are nausea and vomiting. The pain is paroxysmal in character, intervals of relief succeeding intense pain ; there is profuse perspiration, and the pulse is not quickened to any extent. If the pain is severe, the patient may be semi-collapsed. If the gall-stone escape into the intestine, immediate relief follows, if not jaundice is developed, and its degree is in direct relation to the amount of obstruction. The urine contains bile, and of course the motions are pale. The diagnosis is made by the history of the case excluding other causes of colic, the acute spasmodic radiating pain, and the occurrence of jaundice.

SPLENIC DISEASE.

The position of the spleen in health is such, that it cannot, as Sir William Jenner puts it,[1] be "perceptible to the touch. If you can feel the spleen, it is diseased. In health there is a space of about two inches over the spleen, more or less deficient in resonance; this region of imperfect dulness has its lower border near the eleventh rib : its inner and outer borders correspond to the inner and outer margins of the axillary lines . . . in some, the size of the spleen can be tolerably well defined by percussion, in others it cannot." Dr. Sibson gives theupper level of the spleen at the ninth rib, the lower at the twelfth dorsal spine. But the spleen, when enlarged, has certain special characters that are diagnostic ; by pressing the tips of the fingers of the left hand from right to left, and tilting the spleen from behind with the right hand, the organ, if enlarged, will be *felt*, *at least at the end of respiration*, for *the spleen moves with respiration;* then there is *no resonance over it*—that is, no intestine ; it has a *sharp edge in front*, and a *notch in it* which can often be felt, and *it can be moved* by the hands. The hands can be got behind an enlarged spleen. Now the spleen is enlarged in those who have resided in malarious districts, or who have had repeated attacks of intermittent fever, in the acute specific diseases, also in leucocythæmia, in rickety subjects, in connection with cirrhosis and waxy or lardaceous change in the liver, and cancer and tudercular disease of the organ. In the enlargement of the spleen in fevers the organ is tender. The diagnosis has sometimes to be made from enlarged liver, but the confusion cannot be made if we take care to feel the sharp edge of the spleen, and in cancerous or other tumors about the splenic region there could be no movement by respiration or by palpation, &c. Splenic enlargement is mostly accompanied by an excess of white corpuscles in the blood.

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[1] British Medical Journal, Jan. 16, 1869.

RENAL DISEASES.

Position of the Kidneys in Health.—Dr. Sibson states that the upper edge of the right kidney is usually on a line with the space between the eleventh and twelfth dorsal spines, the lower edge being at the third lumbar spine. The left kidney is a little higher. The pelvis of either kidney is on a level with the first lumbar spine (see remarks on abdominal regions). The kidney, in very thin persons, may be felt between the hands, as we have elsewhere stated, and it moves slightly during respiration—descending in inspiration.

The Kidney enlarged from Disease is not movable by hand, or in respiration, as the rule, because of the existence of adhesions. Sir William Jenner makes the remark,[1] that the kidneys always have rounded and never sharp edges, be they ever so enlarged. There is the ascending colon in front of the right, and the descending of the left kidney, and there is no bulging in the loins. The tumors likely to be mistaken for enlarged kidneys are enlargement of the right portion of the liver, fecal accumulation in the colon (very rare), big spleen (with its sharp edge), abscess about the kidney (producing bulging, however), and cancer of the supra-renal capsule.

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[1] British Medical Journal, Jan. 10, 1869.

We now proceed to speak of the more important renal diseases; the morbid states of urine will be described in Chapter XIV, Sect. 4. Certain functional derangements have been noticed.

Renal Congestion very generally occurs as the consequence of heart disease, or in altered blood states, as in typhus fever. The symptoms are, lumbar pain and tenderness, scanty secretion of urine, and the presence of albumen in the urine, and fibrinous casts, or even blood casts when the congestion is marked—from the escape of liquor sanguinis or blood into the uriniferous tubes. In congestion following low fevers, the coagulability of the blood is lessened, and hence the albumen may not be very, or but slightly, perceptible.

Nephritis.—By this is meant acute inflammation of the parenchyma of the kidney. It is a rare disease, and when it occurs is associated mostly with pyelitis or inflammation of the pelvis and calyces of the kidney. Nephritis is characterized by lumbar pain, and tenderness on one or both sides, perhaps hæmaturia, albumen in the urine, diminution of urinary secretion, irritability of the bladder; fever, nausea, and vomiting, and if matter form and find its way into the pelvis, or there be pyelitis present, purulent casts are found in the urine with free pus; the abscess may, however, point in the abdominal wall.

Pyelitis is mostly caused by calculi; there is lumbar pain denoting kidney mischief, often a history of nephritic colic, then the presence of pus in the urine, which may be discharged freely at different times. If there be no nephritis there will be no casts in the urine. Paroxysmal pain (nephritic colic) may occur in the course of pyelitis. The pus may accumulate in the pelvis of the kidney if the ureter be obstructed, and form a tumor. Pyelitis may also follow from obstruction to the flow of urine from the bladder, in disease of that organ, or from the presence of the entozoon—the eustrongylus gigas—

in the pelvis of the kidney. In the early stage there is febrile disturbance; in the late, emaciation. In diagnosing pyelitis we are guided by symptoms pointing to kidney mischief, and an absence of bladder disease and the persistent flow of pus, and the evidence of calculus in the kidney.

There are cases in which the tissues around the kidneys are inflamed (*perinephritis*), forming distinct renal tumor, but here there is an entire want of symptoms or conditions of urine indicating change in the kidney itself. Simple dilatation of the pelvis of the kidney by urine is called hydronephrosis. The kidney structure is gradually obliterated by pressure till the whole becomes a cyst.

Bright's Disease.—In the year 1827 Dr. Bright pointed out the frequent concurrence of dropsy with albumen in the urine and organic diseases of the kidney. Since his time it has been shown that not one kind but many different structural alterations of the kidney are connected with albuminuria and dropsy. The term Bright's disease is now regarded as "the generic term, including several forms of acute and chronic diseases of the kidney usually associated with albumen in the urine, and frequently with dropsy, and with various secondary changes resulting from deterioration of the blood."[1] Bright's disease may be the result of congestion, of acute inflammation, of albuminoid changes, of cirrhosis, and of fatty degeneration. It is usual to describe two forms of Bright's disease—acute and chronic. The acute includes what is known as acute desquamative nephritis. The chronic the other forms of the disease above-named. The acute form is the result of catching cold, checked perspiration, intemperance, and especially scarlet fever. The symptoms are those of nephritis, with dropsy seen at first about the eyes as puffiness in the morning, frequent urination but scanty quantity of urine, albumen in the urine, and more or less of epithelial casts (see Chapter XIV). This state improves gradually, or uræmia supervenes, or chronic Bright's disease ensues. It is important to observe that in Bright's disease, though the amount of albumen may vary, yet it is always present in the urine. Temporary albuminuria may occur in many diseases. It is seen in pneumonia, pleurisy, peritonitis, erysipelas, fevers, the exanthemata, phthisis, depraved states of blood, paraplegia, mechanical congestion, and from admixture of pus with the urine; but in these cases we have no casts, and the albumen does not persist.

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[1] Coll. of Phys. New Nomenclature Report, p. 111.

Chronic Bright's Disease is mostly insidious. There is loss of strength, pallor of the countenance, frequent micturition, and perhaps dyspnœa, but the occurrence of dropsy often first draws attention to the state of the kidneys. There is no pain; there may be slight tenderness over them. In the contracted kidney the anasarca is often not marked, the urine even not albuminous sometimes, though casts exist in it. When attention is directed to the urine, the latter is found to be scanty, though frequently passed, of low specific gravity, containing few solids—very little urea; it is faintly acid or neutral, pale, and on microscopical examination various kinds of casts and altered renal cells, pus, blood, &c., are detected in various amounts. General symptoms of gravity are then developed, anæmia is marked, the digestion is impaired, and diarrhœa may set in; effusions take place into the chest and cause dyspnœa, &c. The blood being loaded with urea disorders the nervous system, hence there is headache, amaurosis, epileptic seizures, and in severe cases, coma. Intercurrent attacks of an acute kind are common. Local inflammations of the pericardium, and pleurisy, are apt to occur, and hypertrophy and dilatation, without valve disease, of the left ventricle is common. Dr. George Johnson[1] has recently demonstrated that the coats of the small arteries in various parts of the body in Bright's disease are thickened and hypertrophied, and he believes that this condition gives rise to obstruction which leads to the cardiac hypertrophy. The old view was, that the altered blood would not pass readily through the capillaries, and so obstruction was caused. For the mode of detecting albumen see Chapter XIV.

Saccharine Diabetes is characterized by the occurrence of an inordinate flow of urine containing sugar. Diabetes was at one time regarded as an affection arising from a perverted action of the kidney. It was thought that by some modification of its functional activity, the sugar discharged was produced by it out of the elements of the blood circulating through its vessels. The discovery that the sugar, however, existed preformed in the blood, rendered this theory untenable, and it was now suggested that the seat of error was located in the digestive apparatus. McGregor's experimental observations gave origin to the notion, that by a morbid action of the stomach sugar was produced out of food that ought to have proceeded to another destination. Bernard's results were next made known. The liver was looked upon as possessing a sugar-forming function, and diabetes was referred either to an excessive production of sugar by this organ on the one hand, or else to a diminished destruction of it in the lungs on the other. It was thought that the production and destruction of sugar balanced each other under natural circumstances, whilst in diabetes, from an error on one side or the other, this balance was disturbed. According to Dr. Pavy's researches, the mode of experimenting upon which these conclusions were based is at fault. Bernard's results went to show that the liver of an animal, to the exclusion of all the other organs of the body, is charged with a large quantity of sugar, and that sugar also exists largely in the blood contained in the circulatory system between this organ and the lungs, whilst on the other side of the lungs a comparative absence of sugar is encountered. From this it was naturally inferred that sugar was produced by the liver and poured into the circulation through the hepatic veins and carried to the lungs, where it underwent destruction. To obtain these results, the arterial blood was collected during life, whilst the liver and the blood escaping from it were taken in an ordinary manner for examination after death. Now Dr. Pavy has shown that by such a method of procedure a true representation fails to be obtained of the living state; a change takes place with remarkable rapidity after death, and gives rise to a condition different from that existing during life. By adopting certain precautions, he finds that there is no appreciable difference as regards sugar to be discovered under physiological circumstances, between the blood flowing to and that flowing from the lungs, and also that the liver in reality is not charged with sugar during life, as it had been inferred to be from Bernard's experiments. There is a principle, the amyloid substance, contained in the liver which has a strong chemical tendency to pass into sugar, and does so immediately after death, giving rise to the condition that is encountered when an ordinary examination is made. By taking steps to prevent this post-mortem change occurring, no sugar, or, any, only a barely appreciable amount, is to be discovered. Dr. Pavy considers that instead of being physiologically destined for forming sugar, the liver exerts an assimilative action over that which is absorbed from the alimentary canal, and so prepares it for subsequent utilization in the system. In diabetes, he says, there exists a want of this natural assimilative power, and hence it arises that the starch and sugar of the food fail to be of service in the economy, and pass off under the form of sugar with the urine. That sugar should still be discharged, as often happens in cases of diabetes, notwithstanding a strict exclusion of starch and sugar from the food, he accounts for by a downward metamorphosis of the amyloid substance contained in the liver and derived from animal food; for, although as he has shown amyloid substance is producible from the starchy and saccharine alimentary principles, it is also present under subsistence upon a strictly animal diet. The view taken tallies with the well-known influence of diet upon the elimination of sugar in diabetes. The symptoms of diabetes are malaise, slight pyrexia, marked thirst, excessive and frequent urination, emaciation, increase of appetite, vertigo, a harsh skin, dry fæces, foul dry mouth, failure of the sexual powers, hectic fever, œdema, diarrhœa, &c. The urine is of high specific gravity, 1030 to 1070, of sweet taste and odor, neutral or faintly acid, and large in quantity. (For tests for sugar see Chapter XIV.)

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[1] British Medical Journal, Jan. 18, 1869.

HÆMATURIA.

Blood in the urine may come from any part of the urinary passages, hence symptoms of bladder, urethral, or kidney disease will guide to the source. When the source is the kidney, blood may be effused in congestive nephritis, calculous pyelitis, the early stage of Bright's disease, cancer and tubercle of the kidney, from altered blood states as purpura, scurvy, typhus, and from blows and injuries. In renal hæmaturia there are blood casts. Of late years endemic hæmaturia has been recognized as being produced in Egypt, Mauritius, and the Cape especially, by the presence of an entozoon, the Bilharzia hæmatobia. When this is the case the ova of the entozoon are found in the urine.

DISEASES OF THE PANCREAS.

In health the pancreas is situated across the spine on a level behind with the eleventh dorsal above, and the first lumbar spine below; in front in very thin persons it may be occasionally felt, or would be felt if diseased, just above the umbilicus. Disease of this organ is difficult to diagnose; the most common enlargement is cancer, and we should arrive at the nature of the disease by feeling a hard immovable mass over the spine in front, unaccompanied by symptoms referable to liver, pylorus, or spleen. In pancreatic disease the stools are said to be peculiarly fatty.

OVARIAN TUMORS.

"Three varieties of tumors are met with in the ovary, viz., the fibrous or solid, the cancerous, and the cystic.

"Cystic disease of the ovary—the common ovarian tumor—consists in the conversion of the gland, or of parts of it, into cysts. These cysts, in at least the majority of cases, have their origin in the Graafian vesicles.

"There are three varieties of ovarian cysts,—the simple or unilocular; the compound, multilocular, or proliferous; and the dermoid cysts. The simple cysts are less frequently met with than the compound; they often attain a considerable size. The multilocular tumor is the most common; the cysts vary in size, there frequently being one large one, with a number of smaller sacs congregated towards the pedicle. The dermoid cysts (or ovular growths, as Dr. Tanner would call them) are peculiar, inasmuch as they are examples of an attempted development of the ovule or ovum, without fecundation; such growths containing skin, bone, hair, teeth, and sebaceous matter.

"The greater number of cases of ovarian tumors occur between the ages of thirty and forty, and next between twenty and thirty. The disease affects both married and single women—perhaps the former more frequently than the latter; while the sufferers from it are often sterile, or at all events their pregnancies have been few.

"The *diagnosis* of this disease is not always so easy as the physician might imagine from examining a well-marked case. In the early period, when the tumor is confined to the cavity of the pelvis, the patient seldom seeks advice; since she is either unaware of the existence of any morbid condition, or if she experience some slight inconvenience she deceives herself as to its cause. At this stage, however, if by chance an examination per vaginam be made, a tumor varying from the size of a hen's egg to that of a large orange, will be discovered on one side or other of the uterus; while the vagina will be found elongated, and the os uteri drawn upwards and towards the affected side. At the same period inspection of the abdomen will detect the existence of a certain amount of fulness on one side of the hypogastrium, or in one of the iliac regions. As the enlargement increases, the abdominal swelling becomes more symmetrical; so that when the tumor has reached the umbilicus, it is often somewhat difficult to decide whether one side of the abdomen presents any greater prominence than the other. Many practitioners imagine that an ovarian tumor always occupies the side on which the disease is situated, while the pregnant uterus is believed to have its centre as constantly in the median line; but neither of these propositions is absolutely correct.

"A small ovarian tumor is more likely to be mistaken for a fibroid tumor growing from the side of the uterus, or for a distended urinary bladder, or for an abscess in the broad ligament, or for an extra-uterine gestation, than for the pregnant uterus. But the former may often be distinguished by the feeling of great elasticity, hardly amounting to fluctuation, communicated to the touch on making a vaginal examination; by the facility with which the sound can be passed into the uterine cavity, and the manner in which the uterus can be perceptibly moved away from the tumor and independently of it; by the persistence of the tumor after emptying the bladder with the catheter; by the non-existence of those constitutional symptoms which arise from inflammation ending in suppuration; and by the absence of those firm inequalities of surface which are produced by the different parts of the fœtus. The history of each case, and the duration of the symptoms, will also afford material help in forming the diagnosis: though I have seen recent cases of ovarian dropsy where there has existed suppression or irregularity of the catamenia, morning nausea and vomiting, indigestion, troublesome constipation, irritability of the bladder, a sense of movement in the abdomen, and swelling with tenderness of the breasts.

"The chief diagnostic marks of an ovarian tumor which has attained a large size are the following: The abdomen is found more or less completely occupied by the morbid growth; the enlargement being smooth and rounded without any prominences when the disease is of the unilocular variety, but often very uneven in the multilocular form. A practitioner has been known to confidently assert that the limbs of a child could be distinctly felt through the parietes, when there was only an ovarian tumor causing a considerable inequality of surface. In the erect posture, as well as in the supine, the tumor projects forwards, the flanks being undistended. In the multilocular, more commonly than in the unilocular tumor, the superficial veins coursing over the abdomen are seen to be enlarged; and it has been thought by some observers that the vessels on the side corresponding to the diseased ovary are generally the most distended. This observation, however, I have not been able to confirm. Pressure with the hand on the tumor communicates a sensation of great resistance; this resistance being most equable in the case of the unilocular disease, though it is almost the same in the multilocular tumor when there are large cells. Fluctuation is always very distinct where there is only one cyst; being of course more imperfect and obscure where there are several, and no single one of great size. Unless the morbid growth is very large and projects into the loins, or unless ascites coexists, fluctuation will not be detected in the flanks. The more viscid the contents of the cyst, the more obscure will be the fluctuation, as a general rule; and the same remark holds good when the cyst-walls are very thick, or when the sac is very much distended. The pulsations of the aorta are sometimes communicated to the hand laid over the tumor. Percussion elicits a dull sound over the whole of the tumor, the only exceptions being when a coil of intestine passes between the tumor and abdominal wall, as it sometimes does just above the pubes; or when the cyst has been tapped, and has afterwards filled with air; or when a cyst has emptied itself into the intestine, and flatus has passed from the latter into the former. The dulness is uniform over the mass of the tumor, and its note is not affected by change in the posture of the patient; but there is resonance above the tumor, and into that lumbar region into which the intestines have been forced, which is always the one corresponding to the healthy gland. By auscultation a murmur can sometimes be heard in one or both iliac regions, owing to pressure exerted by the diseased mass upon the iliac arteries; otherwise only information of a negative kind is gained, there being an absence of borborygmi, and of course the sounds produced by pregnancy. Cysts of moderate size, when free from adhesions, do not modify the respiratory movements; but when the growths are large they restrain the descent of the diaphragm, and especially do they do so when adherent. And then, in every case the signs of pregnancy should be looked for; not only to prevent any gross mistake in diagnosis, but so as to avoid the more excusable error of overlooking the coexistence of utero-gestation with ovarian dropsy.

"The diseases which have chiefly been mistaken for ovarian tumors are the following: Fibroid and fibro-cystic tumors of the uterus, especially when these have attained a great size. Instances of ascites, with a much enlarged spleen; or other examples of peritoneal dropsy, where the effusion of fluid is so copious that the intestines cannot float on its surface and consequently there is dulness on percussion. Cases of extra-uterine pregnancy, which have gone on until the death of the fœtus without rupture of the cyst. Enlargements of the kidney, either from hydronephrosis or cancer. Hydatid tumors of the liver, and of the omentum. A tumefaction produced by a mass of intestines bound together by old peritoneal adhesions. Malignant and other growths from the peritoneum. Phantom tumors of the abdomen; the result probably of abnormal muscular action, combined with flatulence, and an excessive accumulation of fat in the abdominal parietes as well as in the omentum. And lastly, extensive collections of fæces, filling the rectum and even the greater portion of the colon, have led to an incorrect suspicion of ovarian disease."[1]

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[1] "Practice of Medicine," 6th edition, vol. ii, pp. 360–364.

CHAPTER XI.

GENERAL REMARKS ON THE DIAGNOSIS OF BRAIN DISEASES.

WE do not propose to describe every disease in detail. All that will be possible is an attempt to indicate the diagnostic features of the more common cerebral affections.

Now the most important point to recollect at starting is this, that similar brain symptoms may result from changes in the brain itself, and changes in the blood-current; and therefore the physician should seek first of all for special disordered states of blood, as uræmia. In children especially, brain symptoms arise in febrile disturbances, the exanthemata, local inflammations—ex., pneumonia—and other disorders. But here the brain symptoms will be in the minus, the extra brain mischief well defined and marked, whereas, when the brain itself is at fault, there will be little evidence of organic disease outside it. Vomiting and headache are symptoms upon which much stress is laid in diagnosing brain diseases. In vomiting of cerebral origin there is no anteceding nausea; it continues if the stomach is emptied; the tongue is clean, there is no evidence of jaundice or the like about the conjunctivæ, there is marked constipation, headache is not relieved by vomiting, and there may be no anorexia. In vomiting of stomach origin, there is nausea, relief after ejection of the contents of the stomach, which will soon retain food, the tongue is foul, the conjunctivæ muddy; oftentimes there are pains in the belly, diarrhœa, an increased flow of saliva and retching, disgust for food, and signs perhaps of disordered liver.

It is held that in disease of the meninges of the brain there is rather an increase of cerebral functions at the outset, with pain; the delirium is noisy and violent, and convulsions generally occur; whereas, in disease of the brain substance there is no exaggeration, but a diminution of function, so to speak, from the outset; the tendency being to insensibility and paralysis. In meningeal disease there is much general and local disturbance; this is not the case in true cerebral disease.

Acute Meningitis is rare. It results from traumatic causes, disease of the ear, &c. It has little premonition; a rigor is quickly followed by high fever, great pain, and violent delirium. The patient is highly sensitive to every sound, there are frequent twitchings, flushing and pallor of the face alternately, a hard pulse, and the delirium is succeeded by coma.

Cerebritis, or inflammation of the brain, is *per se*, very rare also. It is characterized by the occurrence of acute and persistent pain, disturbance of the functions of the special senses, together with fever, vomiting, prostration, convulsive phenomena giving place to coma, and perhaps paralysis. Abscesses may form. Generally speaking, if the brain is affected the meninges are also implicated. Then we have

Encephalitis.—The symptoms of meningitis show themselves, and these are succeeded by a stage of collapse, in which the patient becomes stupid; the special senses are blunted, the pupils dilate—there may be squinting—speech is thick and indistinct, and a typhoid state, with relaxation of the spincters, closes the scene; the attack may consist mainly of convulsions, succeeded by a comatose condition.

Acute Hydrocephalus, or Tubercular Meningitis, is one of the most important diseases with which the student can be acquainted. In it there are gray granulations of tuberculous nature formed about the membranes at the base of the brain. The disease occurs in children especially about the period of the second dentition. The child, for some ten days or so, seems dull, peevish, loses (or has gradually lost) flesh, is feverish at night, and may complain of headache, or chilliness, or even vomiting, without apparent cause. The bowels are constipated. The temper is very irritable. There may be an improvement for a few days, but then there is a relapse; convulsions (not common), or squinting (common) succeed, with intolerance of light, and wandering at night. There is pain in the head, which makes the child cry out, and often put both its hands to its head, with the cry of "Oh, my head!" The pulse is irregular and there may be ptosis. To this succeeds the third stage, in which the child becomes comatose, convulsed, or paralyzed, whilst an apparent, but deceptive, amendment may happen just before death. The ophthalmoscope detects, in the early stage, spots of retinal and choroid congestion, dilatation and varicosity of the retinal veins around the papilla, and retinal hemorrhage occasionally. The existence of tubercle can be detected in some other organ. Tubercular meningitis may come on in the adult. In this case there is a history of pre-existing lung disease, which seems to get better as the cerebral symptoms develop. There is no very great excitement of the brain, but intense headache, succeeded by stupidity—the patient refusing to make any reply when spoken to, &c.; the pulse is weak and irregular, convulsions, paralysis, and coma ensue before death.

Chronic Hydrocephalus is characterized by a collection of serosity generally in the ventricles, or in the sac of the arachnoid, often in connection with congenital malformation of the brain. In tubercular meningitis there is a large quantity of fluid rapidly poured out into the ventricles as a result of acute inflammation, hence the term acute hydrocephalus; but this is a wholly different affair from the condition found in chronic hydrocephalus. The head is large, the cranial sutures are unossified and wide apart, the fontanelles open and large, the eyes prominent and directed downward, the face small by comparison. The symptoms commence oftentimes when the child is about half a year old, and the most diagnostic signs are those presented by the skull. Subsequently emaciation, great appetite, dulness, peevishness, disordered digestion, muscular weakness, squinting, rolling of the eyes, weak sight, great weight of head, staggering gait, screaming, and grinding of the teeth occur, to be followed by stupor, alteration of the pupils, great prostration, convulsions, paralysis, and death in the one instance, or an abatement of the symptoms when recovery is about to take place in the other.

Hydrencephaloid Disease.—In debilitated children, diarrhœa or other exhausting discharges will sometimes bring on severe brain symptoms somewhat like those of hydrocephalus—ex., heaviness, drowsiness, irritability of temper, marked susceptibility to external impressions, and other symptoms; but in these cases the *fontanelles are found to be depressed*, and it is clear that there is lessened cerebral circulation, and that stimulants, and free nourishment are needed.

Apoplexy.—This is a term used for a sudden attack of loss of consciousness, sensation, and power of voluntary motion, together with more or less disturbance of the functions of respiration and circulation. Apoplexy is induced by several causes. The most usual cause is undue pressure on the brain from hemorrhage into its substance. The blood may be also poured into the arachnoid (that is, upon the brain), or the apoplexy may be due to sudden and intense congestion (*simple* or *congestive* apoplexy), or to the rapid outpouring of a large amount of serum (*serous* apoplexy). It will be at once seen that anything that tends to induce congestion of the brain or to impede the circulation through it, favors the occurrence of apoplexy. Disease of the coats of the cerebral vessels will also aid, as is the case in Bright's disease, gouty subjects, and aged persons. Hypertrophy of the heart is another condition predisposing to it, and lastly, embolism of the cerebral arteries will induce apoplexy.

It is usual to describe three forms of attack—the one, in which the patient without warning falls down, insensible and paralyzed; the sphincters being relaxed, the urine and fæces involuntarily passed, the skin is covered with cold perspiration, the face livid, the pupils dilated, the breathing laborious—a condition of things which may terminate in death in a few minutes. The second form, in which the first symptoms are, acute pain in the head, vomiting, and faintness, with pallor of the countenance; in fact sudden pains in the head, followed by symptoms of syncope; sometimes the patient only staggers and does not fall; the consciousness is only temporarily lost, and the patient recovers, though the headache holds on, to be followed in a few hours by "coma." In the third form there is sudden paralysis without loss of consciousness. Supposing loss of consciousness to occur, if it be profound the patient cannot be roused in any way. The "coma" may pass off completely in a short time without leaving behind any ill effect, or there may be imperfect recovery with a varying amount of paralysis or mental impairment. An apoplectic seizure very often occurs in the night, the patient on waking up in the morning finding himself paralyzed. It is often possible to define the nature of the brain lesion, whether it depends upon congestion or upon hemorrhage. When apoplexy is dependent on congestion, the attack is preceded by important symptoms; the patient's mind is dull, his memory treacherous, his power of thinking weakened, he sleeps badly, is giddy, has a sense of fulness in his head, wakes up in nightmare, has sometimes double vision, he is dizzy, his sense of hearing is disturbed, there are noises in his head, sensation is disordered, his limbs are numbed, and he feels pins and needles in his fingers or toes, the face is flushed, and the apoplectic attack follows some exertion. The loss of consciousness is not extreme, and the patient is again sensible in a few minutes, though his mental condition is somewhat confused, and the paralysis is incomplete. When hemorrhage occurs, as before observed, there is little premonition, it does not follow exertion, the "coma" is prolonged, and the paralysis marked.

With regard to the seat of hemorrhage, the side of the brain affected is that opposite the paralyzed side. It may be otherwise with the face. If the corpus striatum is affected, the opposite side of the body is paralyzed as regards motion; if the optic thalamus is the seat of hemorrhage, there is paralysis of sensation on the opposite side, with disturbance of vision; if the "crus cerebri" or one-half of the "pons Varolii" be the seat of mischief, there is paralysis both of motion and sensation on the opposite side, the pupil is also dilated on the affected side, and there may be ptosis and external squint. Any disease of the centre of the pons Varolii is followed by paralysis on both sides, with disturbance of the muscular movement of the eyes (internal squint), and of the function of hearing. Disease of the "cerebellum" is followed by disorder of muscular movements on the side of the body opposite to that of the cerebellum affected. Disease of the medulla affects the respiratory movements and deglutition. These are of course approximate statements.

The seat of disease is always more or less complicated. The most important thing for the student is to be able to diagnose apoplexy from other diseases with which it is liable to be confounded, such as drunkenness and narcotic poisoning. In "alcoholic coma" the breath possesses the odor of alcohol, and this is also detected in the vomited matters; patients can be momentarily roused; stertorous breathing is absent, the pupils are equal and mostly dilated, the pulse is soft, feeble, and increased in frequency. There is no difference in the condition as to the "motor power," or the existence of paralysis or rigidity on the two sides of the body. In apoplexy the patients cannot be roused, the pulse is slow, stertor is well marked, the pupils are often unequal, and there is often distinct paralysis, or unequal movements in the two sides. The "coma" of epilepsy resembles that of apoplexy, but it has been preceded by convulsions; there is foaming at the mouth, whilst the tongue is bitten, and the patient is known to be epileptic. In like manner the coma from uræmia is accompanied by convulsions, dropsy, suppression of urine, or symptoms of serious renal disease. Hemiplegia is infrequent. Supposing a patient gets a slight attack of apoplexy and is apparently recovering, and this is succeeded by an attack of convulsions, with coma and paralysis on both sides, the probability is that there is extensive ventricular hemorrhage. When after an apoplectic seizure rigidity of the muscles comes on, we know that there is inflammatory action set up around the clot.

Cerebral Softening.—There are three kinds—the red or inflammatory, the white, and the yellow. The former is sometimes idiopathic; it may be traumatic, and it is often the termination of ordinary cerebritis or ear disease. Softening may end in an apoplectic attack or paralysis. The antecedent symptoms are those of brain irritation. In the red softening they are more marked, there is distinct pyrexia, pain in the head, often severe, and referred to one spot, giddiness, dulness of intellect, irritability, altered sensation in the limbs (perhaps hyperæsthesia) and in the special senses, there are convulsive movements in the muscles, rigidity, imperfect articulation. As before observed, these are followed by an apoplectic attack. The disease occurs in those of middle age. The distinction between softening and apoplexy is made by the absence of premonition in the latter case. The softening may be connected with tumor. It is almost impossible to tell when abscess has actually formed. Aphasia often exists in softening. Red softening mostly attacks the cerebral convolutions, and next the thalami, corpora striata, and pons. White softening arises from anæmia, as when the supply of blood is cut off by disease of the vessels or embolism, which latter induces sudden hemiplegia mostly of the left side, because the left middle cerebral artery is most frequently blocked up, and from œdema. Yellow softening occurs in old people from disease of arteries, and is followed by impairment of mind, paralysis, and rigidity.

Tumors of the Brain.—Tubercle, cancer, hydatids, fibroids, osseous growths, syphilitic tumors, and aneurisms, occasion symptoms varying with the seat and the rapidity of their growth. Antecedents go for much, as in syphilis. The age is important in cancer and tubercle. Then we exclude other forms of brain mischief. The symptoms of tumor develop gradually, the pain is most intense and persistent, it is referred usually to one spot, and this is the most unvarying symptom. Paralysis and altered sensation of various parts will be induced according to the nerves pressed upon, either in their course or origin. There is often blindness, fits occur, with perhaps little impairment of the mind—an important point of distinction, when it exists, between tumor and chronic softening.

Delirium Tremens.—This disease arises not only from poisoning by alcohol, but opium, and from venereal excess, and it comes on when a drinker meets with an accident, and is thereby depressed. The two main features are delirium and tremors. But there are prodromata; after a debauch the patient loses his appetite, his bowels are confined, and he has one, two, or more sleepless nights, with depression of spirits. The next thing is that the patient becomes suspicious; he has an anxious staring look, casts his eyes here and there rapidly, as if afraid of some imaginary object; he talks nonsense, and incoherently, and his frightened appearance gets worse at night. Sometimes he requests not to be left alone, declaring at the same time that there is nothing the matter with him, and that he wont hurt. He answers quickly and rationally for the moment, but then relapses into his former condition of wandering. His delirium is a busy one; he imagines he has a great deal to do. Then he sees and is alarmed by phantoms, men making faces at him, animals, reptiles running up and down the wall, or over his bed, &c.; and he may at first know that these things are unreal, presently he may act as if he felt they were terribly real; for instance, jump out of window to get out of their way. The insomnia lasts for a day or two, then sleep comes on, and the patient awakes well or much improved. In the attack there is a peculiar tremulousness of the tongue—which is creamy white—and of the muscles. The skin is cool, clammy, the pulse feeble. If the case terminate fatally, a typhoid state comes on, the temperature rises high, and the patient gradually sinks. The diagnosis is always easy from the known habits of the attacked, the busy and peculiar delirium, the tremor, and the absence of inflammatory symptoms.

Epilepsy.[1]—The leading symptoms are usually,—sudden loss of consciousness and sensibility, with clonic spasms of the voluntary muscles, followed by exhaustion and coma; the attack varying in intensity and duration, and having a tendency to recur at intervals. The paroxysmal loss of consciousness is, however, the prominent or important element present in every instance; while not unfrequently it is the only one, there being no evident spasmodic movements of any kind. There are sometimes, though not in the majority of cases, premonitory symptoms sufficient to warn the patient of an approaching seizure. These warnings differ both in character and the length of time they last. In some cases they are too short to allow the sufferer to dismount from horseback, or to get away from the fire, or even to lie down; while in other instances, many minutes, or even hours, elapse between their occurrence and the attack. Spectral illusions, headache, sickness, giddiness, dimness of vision, tremor or twitching, confusion of thought, a vague sense of fear and terror, and especially that peculiar blowing sensation known as the *aura epileptica*, constitute the most frequent premonitory symptoms. The epileptic aura is differently compared by patients to a stream of cold water, or a current of cold or warm air, or the creeping of an insect; the sensation commencing at the extremity of a limb, and more or less rapidly ascending along the skin towards the head. Directly the aura stops the paroxysm takes place.

Symptoms.—The commencement of a typical seizure is generally characterized by a cadaverous pallor of the countenance, and the utterance of either a loud piercing shriek, or a kind of suppressed groan; immediately after which the individual falls to the ground senseless and violently convulsed. Hence the disease has been called by the vulgar the *falling sickness*, or more vaguely *fits*. During the attack, the convulsive movements continue violent. There is gnashing of the teeth, foaming at the mouth, and the tongue is thrust forward and often severely bitten; the eyes are partly opened and suffused, the eyeballs rolling, and the pupils dilated and insensible to light; the pulse becomes feeble, or it may remain natural; and the skin is generally cold and clammy. There may be involuntary defecation and micturition, with or without vomiting; the breathing is laborious or almost suspended; while the face gets flushed, and then livid and turgid. In fact, death seems about to take place from suffocation; when gradually these alarming phenomena subside, the extremities of one side are jerked about, and shortly afterwards all convulsive movements cease. The paroxysm leaves the epileptic insensible, and apparently in a sound sleep; from which he recovers exhausted and with a slight mental confusion or headache, but without any knowledge of what he has just gone through. An attack of vomiting will sometimes follow the attack; while generally there is a copious secretion of almost colorless urine, of low specific gravity, for many hours after the fit.

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[1] Practice of Medicine, 6th edition, p. 466.

The average duration of the fit is three or five or eight minutes; it may, however, last for half an hour or more. The periods at which the seizures recur are variable.

The epileptic fit may be either severe or very slight, constituting the *grand mal* and the *petit mal* of the French. Instead of the severe well-marked phenomena just described there will perhaps be only a momentary loss of consciousness, so that the sufferer does not even stagger or fall (epileptic vertigo). For example, a child may be seized in the middle of its play, which it will resume immediately after the paroxysm, though probably slightly scared; there having been neither convulsion nor staggering,—simply a sudden but complete blank lasting a few seconds. Such a seizure in an adult might be preceded by vertigo; so that he would be glad to hold some object, to which he would be fixed, as it were, during the attack. So again, with the scarcely more than momentary loss of consciousness, there may be twitchings of the muscles of the face and neck, dilatation of the pupils, and pallor of the countenance; succeeded by a dazed feeling, which the individual shakes off with one or two deep inspirations, and an exclamation of being "all right again."

Cerebro-spinal Meningitis.—This might be classed with continued fevers, but as the cerebral symptoms are so marked and peculiar, it has been thought advisable to give the diagnostic features of this important disease here. "A brief recapitulation of the most important symptoms, will aid the practitioner in his attempt to form a correct opinion. The most prominent and constant phenomena are the following: *Headache*, which comes on very early and suddenly, is very severe and is either paroxysmal or persistent to the end. *Vertigo*, often accompanied with faintness and dimness of sight on the patient trying to assume the erect posture. *Prostration*, so great and so rapid as to form a striking feature. *Delirium*, varying from transient wandering to violent mania. *Coma*, a sign of most unfavorable import when deep. *Cutaneous hyperæsthesia*, so that the patients feel sore and ache all over, and groan and struggle when moved. *Darting pains in the limbs and spine*, sometimes compared to shocks of electricity, and causing faintness and sickness. *Neuralgia*, especially of the bowels, so marked in some epidemics that the disease has been popularly known as bellyache. *Tetanic spasms*, the result of the spinal lesions, and of variable severity according to the extent of the changes in the cord and its membranes. *Paralysis*, usually partial. The muscles of deglutition are perhaps those most frequently affected. The power of motion is generally regained at the end of a few weeks, as the process of absorption removes some exudation which has caused pressure on the nerves at their origin. *Vomiting*, which is irrepressible; and as in all cases of cerebral sickness continues whether there be anything in the stomach to be ejected or not. Rarely, the matters thrown up contain altered blood: green bilious fluids are more frequently seen. *Constipation* is not constant, but it is often present as in other cerebral affections. *Cutaneous eruptions* are more common in some epidemics than others; while of the different kinds of eruption, labial herpes and petechiæ have been seen more frequently than purpuric spots or large ecchymoses. Neither *increased heat of skin*, nor *frequency of pulse*, nor *difficult respiration*, nor *albuminuria*, nor *swelling of the parotid or submaxillary glands*, nor *strabismus*, nor *lesions of the organs of sight or hearing* can be called prominent symptoms of this fever, though they may be present."[1]

SPINAL DISEASES.

The main point of distinction between cerebral and spinal disease is the fact, that the mind and the special senses are not deranged. As one might expect, paraplegia, without brain derangement, is the most characteristic condition of spinal disease.

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[1] Practice of Medicine, 6th edition, vol. i, p. 254.

Spinal Meningitis, or inflammation of the membranes of the cord, is a disease of early life, and arises from exposure to cold and wet, or caries of the spine. There is pyrexia, pain all along the spine, extending to the limbs, intensified by movement, and sometimes acutely so. This is followed by rigidity or spasms, with loss of power in the muscles of the limbs, the neck, or back; paralysis, the result of effusion, follows. If the part affected be high up in the spinal canal, the respiratory movements may be disordered; other characteristic symptoms are more or less paralysis of the bladder, and priapism.

Myelitis, or inflammation of the cord, is said to differ from spinal meningitis by the absence of pain and muscular rigidity, and the more marked paralysis of motion and sensation—the latter particularly. But symptoms vary. If the upper part of the cord is diseased, the speech, the heart's action, and the breathing will be affected. There may be tetanus. If the cervical part of the cord be affected, the upper limbs will be palsied, the respirations disordered, and swallowing be interfered with. When the dorsal portion of the cord is diseased, both arms and legs may be affected or semi-paralyzed. When the lumbar part of the cord is specially diseased the muscles of the trunk are convulsed, the lower limbs paralyzed *par excellence*, there is a sense of constriction about the belly, the bladder is paralyzed, the urine alkaline, and the skin is apt to slough. Pain will, in each of these instances, be referred to the spine, over the part mainly affected.

Spinal Apoplexy is generally marked by the sudden occurrence of spinal pain and paraplegia; blood gradually accumulates from below upwards, hence the increase of the paralysis. According to the seat of the effusion, if it be into the cord, will the symptoms vary; if it be high up the breathing may be affected, and the patient very quickly die. Convulsions are not uncommon.

Spinal Irritation is the name given to an hysterical condition accompanied by muscular pains and tenderness over the spine of the vertebræ. There are no grave symptoms. This affection arises in women who have been much depressed or fatigued.

Paraplegia arises from all spinal diseases, injury, and diseases of the vertebræ. It may be suddenly or gradually developed. In marked cases the loss of motion and sensation is complete, and the bladder is paralyzed. the urine becoming ammoniacal and purulent. The insidious form begins by numbness, formication, unsteadiness on the legs, with increasing weakness, till the loss of power is complete; the bladder of course is paralyzed. Sometimes in paraplegia the reflex function is exalted considerably, so that slight irritation induces violent movements, much to the annoyance of the patient. The lower limbs are mostly affected, but if the part of the cord diseased is near the upper dorsal vertebræ the respiration is affected. The upper limbs escape if the disease of the cord be below the second dorsal vertebra. If the seat of mischief is above the fifth cervical, dyspnœa is intense, and so is difficulty of swallowing. Paraplegia is sometimes reflex—that is, due to disease outside the cord—as in disease of the urinary organs or rectum, when symptoms of urinary or bowel disease precede it. In reflex paraplegia (which attacks the lower limbs), sensation is not altered, there is no rigidity in the muscles of the limb, the palsy is not complete; there is no pain over the spine, the bladder is not paralyzed; the urine in fact is not altered unless there be special disease of the bladder, digestion is at fault, there is no wasting of the limbs, and the reflex function is not exalted.

Wasting Palsy.—The modern term for the disease is progressive muscular atrophy, and it is thought now to be an idiopathic fatty degeneration of the muscles. The first symptom is often seen in wasting of the muscles of the ball of the thumb, with pain and then weakness of the upper limb. One or both arms or legs may be affected. The muscles can be made to quiver by irritation or do so without it. Sensation is preserved. The mind is clear. When the muscles of deglutition or mastication are affected, the case becomes serious. Wasting of the muscles continues, producing a characteristic appearance in contrast to the healthy muscular parts. The progress is slow, and the patient dies from apnœa, or inanition, or some intercurrent disease.

Locomotor Ataxy.—The following is Mr. Lockhart Clarke's description of its symptoms: In a great number of instances, the first symptoms make their appearance in the form of strabismus, with diplopia, which may disappear for a time and then return; or in the form of amblyopia or weakness of sight, which may go on to complete amaurosis. After a variable period, these symptoms are accompanied by so-called "rheumatic" and lancinating pains, which occur at variable intervals, in different parts of the limbs. In many cases, the ocular disturbances, except perhaps extreme contraction of one or both pupils, never make their appearance; the pains, which may extend over months or even years, accompanied by some weakness, being the first in the train of symptoms. Either at the same time or subsequently, there is commonly more or less numbness in the feet and legs, in the hands and arms, and sometimes in the face. Sooner or later, the patient begins to find that he cannot properly maintain his balance; that he totters in walking, like a man partially intoxicated, or that he cannot guide the movements of his fingers. He has lost, to a certain extent, the power of controlling the action of some of his voluntary muscles. Still later, the voluntary movements become more or less jerking or spasmodic; and in the course of the disease other symptoms intervene, as incontinence of urine and dysuria, which frequently alternate in the same patient; loss of control over the sphincter ani; generally, though not always, loss of sexual power and desire; occasional hyperæsthesia over certain parts of the limbs; and sensation of tightness around the body and limbs. In rare cases, of which I have seen two, the senses of smell and taste were impaired. Usually, the patient's general health is not much affected, and his intellect remains unimpaired. Locomotor ataxy is a disease which occurs more frequently about the middle period of life, and is much more common in men than in women. The morbid anatomy of locomotor ataxy consists chiefly of a certain gray degeneration and disintegration of the posterior columns of the spinal cord, of the posterior roots of the spinal nerves, of the posterior gray substance or cornua, and sometimes of the cerebral nerves.

CHAPTER XII.

DIAGNOSIS OF SKIN DISEASES.

THERE is no branch of medicine which is less really understood, and in which, as regards diagnosis, more egregious blunders are made, than in that which relates to cutaneous diseases. Perhaps the most glaring illustration of our real ignorance is to be found in the higgledy-piggledy arrangement of diseases of the skin in the new nomenclature Report of the College of Physicians. It is very common to find men of the highest position in the profession freely giving expression to the opinion that there is nothing in "skin diseases," and showing an inclination to speak slightingly of dermatology. No wonder that to most of such men diseases of the skin seem to be incurable. Recent researches however have shown that there is the closest connection between diseases of internal parts or disorder of the body as a whole, and diseases of the skin, and have opened out the widest field for the profoundest inquiry into the connection between nerve disorder and tissue changes as exhibited by cutaneous diseases.

The best clinical groupage of diseases of the skin is the following :

1. Eruptions of acute specific diseases.
2. Local inflammations, (*a*) erythematous or erythemata ; (*b*) catarrhal or eczema ; (*c*) plastic or lichenous ; (*d*) suppurative.
3. Diathetic diseases—strumous, cancerous, syphilitic, leprous, and alphous (lepra vulgaris) affections.
4. Hypertrophies and atrophie
5. Hemorrhagic disorders.
6. Neurotic diseases.
7. Chromatogenous or pigmentary alterations.
8. Parasitic diseases.
9. Diseases of the glands and appendages.

These are the various batches of diseases to recollect.

Some general considerations will now be noticed as aids to diagnosis before the separate eruptions are described.

Firstly. When the patient enters the room we see at once if he or she be really ill. If there be high fever and other symptoms suddenly developed, one of the acute specific or zymotic diseases is denoted—ex., measles, small-pox, &c. Occasionally acute lichen, acute eczema, secondary syphilis, urticaria, herpes zoster, and erysipelas, may be accompanied by severe general symptoms.

Secondly. The character of the eruption is to be noticed, as to its primary as well as its secondary aspect. A scaly stage may have been preceded by a discharging stage (eczema), or it may be a primary one (lepra vulgaris).

Thirdly. The existence of "discharge" or "weeping" at any time in the history of the disease must be detected. It is the easiest point of distinction between chronic eczema and lepra vulgaris.

Fourthly. It should be noted whether the eruption be uniform in its character or multiform. In the one case, for instance, all papules or pustules, or, in the other case, papules, pustules, and vesicles intermingled. The two diseases in which multiformity of eruption occurs are practically scabies and syphilitic eruptions.

Fifthly. It is well to ascertain if the disease be congenital—when it is usually syphilitic, pemphigus, pigmentary, or ichthyosis—or hereditary when it is lepra, ichthyosis, lichen, eczema, or syphilis.

Sixthly. Recurrence is of importance. Lepra vulgaris and syphilitic eruptions are the great recurrers.

Seventhly. The age is important. Before puberty we do not look for syphilitic eruptions. During the first six weeks of life congenital syphilis develops itself; intertrigo, eczema of the scalp, and seborrhœa capillitii also occur about the same time. Syphilitic pemphigus occurs, it is said, before the child is six months old, not afterwards; during the first three months and up to and through the period of dentition, strophulus and eczema are met with. We need only mention important facts. Cancer (epithelioma) is a disease of late life—rare before thirty, but with rodent ulcer common about the age of sixty and beyond. Lupus is a disease which commences in early and young life, and the same may be said of syphilis. The parasitic diseases occur in the young rarely after twenty-one years of age. Herpes circinatus (or, as we call it, tinea circinata) is the form seen in adult life. In old people, prurigo, ecthyma cachecticum, pemphigus, and pruritus, with cancer and rodent ulcer, occur.

Eighthly. Seat of disease must be attended to. "On the *scalp* we frequently have parasitic diseases, kerion, eczema, impetigo, sebaceous cysts, alopecia, and lepra; *ears*, eczema; *forehead*, lepra and herpes zoster; *near the eye*, chromidrosis, rodent ulcer, xanthelasma or vitiligoidea, molluscum; *face generally*, acne, impetigo contagiosa, erysipelas, lichen, syphilitic eruptions, erythema; *nose*, lupus, acne rosacea; *cheeks*, lupus, malignant pustule, acne rosacea; *upper lip*, impetigo sycosiforme, herpes labialis; *lower lip*, epithelioma; *chin*, sycosis; *whiskers*, acne sycosiforme; *angle of mouth*, congenital syphilis; *chest*, chloasma and keloid; *under clavicle*, sudamina; *about the nipples, in women*, scabies; *in the side*, shingles; *outer* and *posterior* aspects of *trunk*, prurigo and lichen, as distinguished from eczema on the *inner* and *front* aspects; *elbows* and *knees*, lepra, psoriasis; *interdigits* and *about wrists*, scabies; *back of hands*, lichen and grocers' and bakers' itch; *palm of hands* alone, syphilitic lepra and erythema; *buttocks and feet of children*, scabies; *upper line of penis*, scabies; *scrotum*, eczema, psoriasis, and epithelioma in chimney-sweepers; *front of leg*, erythema nodosum, and in old people, eczema rubrum; *about the anus in children*, congenital syphilis; travelling or developing, and affecting *generally over the body*, pemphigus foliaceus and pityriasis rubra; *in the bend of joints and armpits*, eczema rubrum; and limited to the *hair follicles*, lichen and pityriasis pilaris; and to these and the *sebaceous glands*, lichen scrofulosus and lichen ruber."[1]

Ninthly. We see if there be loss of substance. When it is distinct it is characteristic of strumous or syphilitic inflammation or lupus; and so old scars are left chiefly by lupus, when there is generally one continuous scarred, larger or smaller patch, or old syphilis, where the scars are many and often scattered in different parts of the body—ex., the legs, arms, and back.

The diagnostic features of individual eruptions may be now shortly given.

ERUPTIONS OF ACUTE SPECIFIC DISEASES.

Variola.—The eruption appears the third day of disease, and travels over the whole body in a day. It consists of pimples, which are hard, red, pointed, having a "shotty" feel, appearing on the face first; on the 2d day of eruption these pimples begin to change into vesicles; 3d day of eruption they umbilicate and begin to pustulate; 5th to 8th day they maturate—that is, the pus formation is free and complete, and there is an inflammatory areola around the pustules. "Secondary fever" now comes on, the spots desiccate and scab, the crusts falling off in two or three days. When the spots run together—that is, when the disease is confluent—these changes are not distinctly seen. They are slightly marked in modified small-pox.

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[1] "Skin Diseases." By Tilbury Fox, M.D. Second edition.

Varicella.—This is a disease of children. After pyrexia of a few hours, or not more than twenty-four, the eruption of varicella appears, often on the back first of all, as distinct red papulæ, which become vesicular in a few hours: the eruption is successive during three or four days. The same kind of changes in the eruption occur as in variola, but the disease is more superficial and the vesicle is unilocular, it is not umbilicated; the contents are serous. On the first day the vesicles are transparent, opalescent on the second and third day, on the fourth they shrink and desiccate, and on the sixth the scabs fall off. Sometimes the contents of the vesicles become puriform. The general symptoms are slight, and there is no secondary fever.

Vaccination.—The changes are as follows:

"First two or three days, *incubation;* 4th, eruption *papular;* 5th to 8th, *vesicular* (umbilication); 8th day, an *areola* appears; 9th to 11th, eruption is *pustular*, umbilication lost, areola enlarged; 15th to 17th, period of *separation.*

Typhus Rash.—This consists of two component parts:

1. A subcutaneous mottling, of a more or less livid hue, and diffused generally over the body.

2. Petechiæ, small, about the size of pins' heads, scattered all over the body, and showing out from the mottling; at first these are but slightly raised, but their color increases gradually in intensity; they do not fade by pressure, except slightly in the very early stages. The eruption of typhus is not prolonged by successive crops. It makes its appearance between the fifth and eighth day of disease, and disappears a few days before convalescence.

Typhoid Rash is characterized by the appearance, between the eighth and twelfth day of disease, of rose-colored, elevated, circular. softish spots, about a line or so in diameter, on the abdomen, back of hand, arms, chest, and back (if kept warm). They disappear by pressure, appear in successive crops, each spot lasting three or four days, and then gradually fading. There may be from half a dozen to a score at one and the same time present. Sudamina often coexist.

Erysipelas—called in Scotland the *rose*, in this country *St. Anthony's fire*—is an inflammatory affection of the skin, and very commonly of the areolar tissue, characterized by the affected part becoming of a shining deep red color, hot, painful, and swollen. No portion of the surface is exempt from attacks of it, but the integuments of the face and head are most commonly the seats of *idiopathic* erysipelas—that which arises from internal causes—while *traumatic* erysipelas—that which follows wounds—may occur on any part.

Idiopathic erysipelas resembles the other exanthemata, inasmuch as it is preceded by fever and general constitutional disturbance. It often sets in with distinct rigors, and sore throat is an early and frequent accompaniment of it; disturbance of the cerebral functions, nausea, vomiting, and diarrhœa may also be present. Then, on the second and third morning from the rigor, redness and swelling appear on some part of the skin, frequently on one side of the nose, spreading to the rest of the face, and often extending over the scalp, neck, and shoulders. The lips swell, the cheeks enlarge, the eyes become closed by their puffy lids, and all traces of the natural features are completely lost. After three or four days the redness fades, the swelling subsides, and the cuticle desquamates. In most cases the inflammation is merely superficial; occasionally it affects the subcutaneous areolar tissue—phlegmonous erysipelas—and is then apt to be followed by suppuration and sloughing.

Erysipelas may prove fatal, by the extension of the inflammation to the brain or its membranes, giving rise to effusion and coma. The same result may occur from the mucous membrane of the glottis becoming affected, so that the chink gets closed, and the patient dies unexpectedly from suffocation. In other cases, death is owing to failure of the vital powers. Erysipelas may arise from infection or from contagion. When it prevails epidemically, as it sometimes does, intemperance, insufficient food, foul air, and trifling injuries favor its occurrence.

Equinia, or Glanders.—Farcinoma, farcy, or glanders, is attended by *symptoms* somewhat similar to those of glanders in the horse—viz., by fever, great debility, pains in the limbs, profuse offensive discharge from the nostrils, and the formation of a number of pustules and tumors in different parts of the body, which have a great tendency to suppurate and become gangrenous. The pustular eruption does not appear until about the twelfth day; it is accompanied by profuse fetid sweats, and sometimes by the formation of black bullæ. The disease generally proves fatal before the twentieth day. It occurs for the most part in grooms, stablemen, &c. There is abundant proof of the transmission of glanders from the horse to man.

Rubeola.—Rubeola (Willan), Morbilli (Sydenham), the Measles (Cullen), are terms employed synonymously to designate a disease, the distinguishing characters of which are a continued contagious fever, accompanied by an eruption, and frequently attended with inflammation of the mucous membrane of the respiratory organs.

The *symptoms* are lassitude, shivering, pyrexia, and catarrh; the conjunctivæ, Schneiderian membrane, and mucous membrane of the fauces, larynx, trachea, and bronchi are much affected. Swelling of the eyelids; eyes suffused and watery, and intolerant of light; sneezing; dry cough, with hoarseness and severe dyspnœa; drowsiness; great heat of skin; frequent and hard pulse. The period of incubation—or, in other words, the time which elapses between the period of infection and the appearance of eruption—is from ten to fifteen days. The eruption comes out on the fourth day of the disease, seldom earlier, often later; it consists of small circular dots, like flea-bites, which gradually coalesce into small blotches of a raspberry color; they present often a horseshoe shape, and are slightly raised above the surface of the skin. The rash appears first on the forehead and face, and gradually extends downwards; it begins to fade on the seventh day in the same order, and is succeeded by slight desquamation of the cuticle, and great itching.

The fever does not abate on the appearance of the eruption, as in small-pox, nor does the severity of the attack at all depend upon the quantity of the rash. Measles is mostly seen in children.

The prognosis must depend upon the mildness or severity of the chest symptoms; the complications most to be feared are croup, bronchitis, and pneumonia. The diarrhœa, which often sets in as the rash declines, is for the most part beneficial.

Anomalous Exanthem.—"After more or less pyrexia, a dusky and red papular rash appears. It is never crescentic, but is uniformly distributed. The redness, the hue of which may vary, is most intense during the first day, when the rash is seen on the face, arms, legs, body, in succession; there may be slight desquamation. There are no catarrhal symptoms, though the fauces are reddened. The patient very quickly recovers, there is no dropsy or renal disease following in its wake. It is not contagious, and it often occurs in those who have already had measles. In one sense it is a satisfactory disease—it requires no treatment."[1]

Scarlatina.—Scarlatina or scarlet fever is a contagious febrile disease, characterized by scarlet efflorescence of the skin and of the mucous membrane of the fauces and tonsils, commencing about the second day of the fever, and declining about the fifth; it is often accompanied by inflammation of the throat, and sometimes of the submaxillary glands. The time which elapses between infection and the period of the eruption varies from four to six days. Like measles, it is essentially a disease of childhood, but is more to be dreaded.

There are three varieties of this disorder. Scarlatina *simplex*, in which the skin only is affected; scarlatina *anginosa*, in which both skin and throat are implicated; and scarlatina *maligna*, in which all the force of the disease seems to be expended upon the throat.

Sequelæ.—Children who have suffered from scarlatina are very liable to have their health permanently affected, and to become afflicted with some of the many forms of scrofula, especially strumous ulcers, ophthalmia, scrofulous enlargements of the cervical glands, diseases of the scalp, &c. But the most frequent and most serious sequel is the form known as acute Bright's disease, or acute desquamative nephritis.

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[1] "Skin Diseases." By Tilbury Fox, M.D. Second edition, pp. 62–63.

LOCAL INFLAMMATIONS.

A. Erythemata are characterized by slight red patches irregularly circumscribed, of variable form and extent, and most frequently seen on the face, chest, and extremities. The duration of an erythema varies from a week to a fortnight; it is seldom preceded or accompanied by febrile symptoms; it causes but slight heat, and no pain; and the prognosis is always favorable. The principal species of this disorder is known as *erythema nodosum*, in which the eruption is confined to the forepart of the leg, taking the form of one or more large oval patches, running parallel to the tibia, and rising into painful protuberances, much resembling nodes. It occurs commonly in young women when badly nourished or overworked.

Roseola.—Roseola is a mild, non-contagious, rosy-hued erythema of the skin, characterized by transient patches of redness, of small size and irregular form, distributed over more or less of the surface of the body; its duration varies from twenty-four hours to six or seven days. The eruption, at first brightly red, gradually subsides into a deep roseate hue, and slowly disappears. It is accompanied by slight fever. There is one form of this affection which frequently affects adults in the summer; it is called *roseola æstiva.* "Roseola is confounded with erythema papulatum and rubeola; but it is never accompanied by distinct catarrh; it is rose-colored at first, gradually getting duller, non-crescentic, occurring in circular patches from half an inch to an inch in diameter; not on the face; it is often very partial. In acute diseases, erythema oftentimes occurs about the arms and limbs, as in cholera or rheumatism. Ordinary erythema is of a darker hue than roseola: it has a bluish tinge at its edge, and is not so well defined—*i. e.*, is more diffuse. Erythema may also arise from friction; from tension, as in œdema; from medicinal substances, as henbane, arsenic, belladonna, copaiba; and after operations, when it is often pyæmic. The erythema of erysipelas is accompanied by tension, shining, smarting, and swelling. E. scarlatiniforme presents all the characters, as regards the rash, of scarlatina, but lacks its general throat symptoms and the peculiar appearance of the tongue. The rash is seen about the neck, the flexures of the joints, and the trunk; it lasts five or six days, and is often more or less evanescent. The rosalia of authors—rubeola notha, or rubella—holds the same relation to rubeola that E. scarlatiniforme does to scarlet fever—that is to say, there is an absence of the general symptoms, whilst the eruption is similar. In all these cases of acute febrile erythemata desquamation is observed. In every instance the redness disappears or is removable by pressure, unlike that of purpura or pellagra. In lupus erythematodes an erythema like chilblains is common; it occurs in summer as well as in winter, and is connected with loss of hair, &c. The erythema of urticaria is very easily diagnosed; a slight scratching with the nail will produce a wheal."[1]

Urticaria.—Urticaria or nettle-rash is a non-contagious, erythematous eruption, characterized by long prominent patches or wheals, either red or white, of irregular shape, of uncertain duration, and accompanied by intense heat, a burning and tingling in the affected spots, and great itching.

There are two varieties: one in which it is acute, running a short, rapid course; another in which it is chronic, very obstinate, and either persistent or intermittent: both forms attack individuals of all ages and constitutions. The chronic intermittent variety is the *urticaria evanida* of Willan; it sometimes lasts for months, or even years.

Urticaria is caused by certain derangements of the digestive organs, arising from the use of particular articles of diet, such as shell-fish of different kinds, cucumbers, mushrooms, bitter almonds; certain medicines, as turpentine, balsam of copaiba, &c.

B. **Catarrhal Inflammation or Eczema** consists of an eruption of small vesicles on various parts of the skin, closely crowded together, and often running into each other, so as to form, on being ruptured, superficial moist excoriations. *The discharge is the characteristic feature.* This discharge stiffens linen, and dries into thin yellow crusts. There are several species of this disease. When the eruption consists of minute vesicles on different parts of the skin, without any inflammation, it is called *eczema simplex;* when the skin is inflamed, and there is heat and swelling, *eczema rubrum.* In *eczema impetiginodes* there is free formation of pus. When arising, as it sometimes does, from great heat, especially from the heat of the sun, it is called *eczema solare;* when as a result of the use of mercury, *eczema mercuriale.* In infants at the breast, and in children during dentition, it often affects the scalp —*eczema capitis.*

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[1] Fox, loc. cit., p. 41.

If the discharge is free, markedly purulent, and the scabs are large, we have *impetigo.*

C. Plastic Inflammation or Lichen.—Here there is no discharge, but deposit of plastic matter in the skin in the form of papules or pimples, scattered or more or less aggregated together. Lichen is readily recognized by the minute, hard, red elevations of the skin which it presents, together with the annoying pruritus. There are three chief forms.

Lichen simplex, in which the eruption consists of small agglomerated papulæ, rarely larger than a millet seed.

Lichen strophulus, or red-gum, tooth-rash, &c., which generally attacks infants at the breast, and is characterized by an eruption of minute, hard, sometimes slightly red pimples, attended with itching, and appearing upon part or the whole surface of the body.

And *Lichen agrius,* in which the papulæ are more inflamed, and developed on an erythematous surface, which appears hot and painfully distended. The itching is very intense, and the duration of this form is often very prolonged.

D. Suppurative Inflammation of the Skin includes ecthyma and boils. Ecthyma is an acute inflammation of the skin, characterized by large, round, prominent pustules, occurring upon any part of the body, though very rarely on the face or scalp. The pustules are usually distinct, seated upon a hard inflamed base, and terminate in red stains or thick dark-colored scabs, which leave superficial ulcers, followed by cicatrices. This disease is often caused by stimulating applications to the skin, such as lime, salt, sugar, &c. Grocers and bricklayers are liable to it, especially when overworked, or when their systems are depressed by bad or insufficient food.

DIATHETIC DISEASES.

All that space permits us to give is the diagnostic features in general of cancer, rodent ulcer, lupus, and syphilis, as follows:

"**Cancer (epithelioma) Tubercles.**—Solitary, flat, *hard,* and tender. Scabs slight. When ulceration sets in the glands enlarge. There is much infiltration around the ulcer, which is papillated, dirty-grayish, ichorous, or semi-scabbed, with hard, everted, and undermined edges. Epithelial elements may be seen by the microscope.

"**Rodent ulcer** begins as a small, pale, pretty soft tubercle, of very slow growth, almost painless, giving rise to an ulcer, without glandular enlargement, presenting a clear surface, not papillary, without ichor, but with *hard*, sinuous, non-everted, and non-undermined edges.

"**Lupus** has at its base an erythema that looks like searing; then upon this arise dullish-red, softish, round, gelatinous-looking tubercles, forming patches of various extent. Thin adherent crusts form. There is no pain. The course is indolent. The edges of the patches are inflammatory, rounded, and raised, but not everted. There is always a tendency to repair, and cicatrices form, accompanied by distinct loss of substance.

"**Syphilis.**—Tubercles commence as papules; they become hard, large, and flattish, but not so flat as those of lupus; they are dull-red at first, then coppery, and disposed in circles, or serpiginous, covered by thick dark scales. There is an ulcerating and a non-ulcerating form, the ulceration being often serpiginous and misnamed 'lupus.' Syphilitic tubercles often occur about the face. The ulceration is dirty, ashy gray, sloughy, and ichorous, the edges sharply cut and everted, surrounded by tubercles of a copper tint."[1]

Lepra vulgaris or Psoriasis is characterized by the occurrence of white scaly patches in various parts of the body, especially the elbows, the scales being a primary condition, and composed entirely of epithelial cells and no inflammatory products. There is no discharge. Once seen it should never be mistaken for anything else.

Hypertrophies and atrophies include ichthyosis, xeroderma, warts, keloid, fibroma, bucnæmia, and linear atrophy.

Hemorrhagic diseases include purpura, which consists of a morbid condition of the capillaries, owing to which blood is effused into the different tissues of the body, the effusion giving rise to the formation of sanguineous patches of various size. When the patches are small—mere spots—they are termed *petechiæ;* when large, *ecchymoses.*

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[1] "Skin Diseases." By Tilbury Fox, M.D. Second edition, p. 43.

The spots vary in color, being either red, purple, livid, or reddish-brown; they bear a great resemblance to bruises; pressure does not efface them. Five varieties are usually enumerated—namely, purpura simplex, purpura urticans, purpura hæmorrhagica, purpura senilis, and purpura cachectica. This disease must not be confounded with scurvy, which it somewhat resembles. It differs, however, inasmuch as it often appears suddenly, is not attended by a livid, spongy state of the gums, and is not owing to any want of vegetable food.

NEUROTIC DISEASES.

Prurigo.—Willan describes three varieties—*prurigo mitis*, *prurigo formicans*, and *prurigo senilis.* The first is the mildest form; in the second, the itching is combined with a sensation like the creeping of ants or the stinging of insects; while the third occurs in old persons, and is the most obstinate, often continuing for the rest of the patient's life. In the diagnosis of prurigo care must be taken not to confound it with the itching which arises from the presence of pediculi, which are common in the aged poor.

"Prurigo is known by the peculiar dark aspect of the papulæ at their apices, their dissemination on the outer and posterior aspects of the limbs and back; by the peculiar pruritus, the unhealthy, flaccid, dirty state of skin, and the uniformity of the eruption. In lichen, the papulæ are light-colored, and without dark apices; the disease occurs on the inner aspect of the limbs, &c.; there is no 'urtication,' the surface is not withered, but dry, thickened, harsh, not flaccid. In scabies, the eruption is multiform, seated about the interdigital spaces, on the front parts of the arm and body; the skin is apparently healthy, there is no burning pruritus; it also occurs on the seats of pressure, especially the tuberosities of the ischium, and exhibits the characteristic vesicle and furrow; in addition prurigo occurs not only on the outer aspect of the limbs, but also generally above the level of the nipple-line and below the upper part of the thigh; scabies, on the other hand, is seen mostly between these two lines of demarcation."[1]

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[1] "Skin Diseases." By Tilbury Fox, M.D. Second edition, pp. 368–9.

Herpes.—Herpes, or tetter, is a transient non-contagious affection, consisting of clusters of vesicles upon inflamed patches of irregular size and form. The eruption runs a definite course, rarely continuing for more than two or three weeks; it is not usually severe, nor is it accompanied by any constitutional symptoms. Care must be taken not to mistake its nature, since *herpes præputialis* has been actively treated as syphilis. A singular species of this disease is known as *herpes zoster*, or *zona*, or the *shingles*, in which the inflamed patches with their clustered vesicles are arranged in the form of a band, encircling half the circumference of the body; in nineteen cases out of twenty the zone will be found to occupy the right side of the body.

Pemphigus.—This affection is characterized by the appearance of large bullæ, two or three inches in diameter, upon one or more regions of the body. The eruption is generally preceded for twenty-four or forty-eight hours by slight general indisposition, fever, and itching of the skin; small red circular patches then form, gradually increase in extent, and become covered with bullæ, which either fade away on attaining their full size, or burst, and are replaced by thin brownish-colored incrustations. The duration of this disease is usually from one to three weeks, although it occasionally becomes chronic and prolonged for months.

Rupia.—Rupia may be considered as a modification of pemphigus occurring in persons of debilitated constitutions, and in those whose systems have been contaminated with the poison of syphilis. It is characterized by the eruption of small flattened bullæ, containing at first serous fluid, which soon becomes purulent or sanguinolent, and concretes or dries into dark, black, conical crusts. When the crusts fall off, they leave circular ulcers, of various sizes, indisposed to heal. The lower extremities are most frequently affected. Its duration varies from two or three weeks to several months. It should be transferred to syphilitic eruptions.

PARASITIC DISEASES.

These affections are due either to vegetable or animal parasites. Those due to fungi are—

"1. Tinea favosa (commonly called favus).
"2. Tinea tonsurans (ordinary ringworm of the scalp).
"3. Tinea kerion (a modification of tinea tonsurans).

"4. Tinea circinata (ordinary ringworm of the body).
"5. Tinea sycosis (mentagra, or simply sycosis).
"6. Tinea decalvans (area, or one form of alopecia).
"7. Tinea versicolor (chloasma, or pityriasis versicolor).
"8. Tinea tarsi.
"9. Mycetoma, or the madura foot of India.
"10. Onychia parasitica, or onychomycosis; this occurs as the sole disease or as a part of the more common forms of tinea."

Tinea Favosa most commonly affects the scalp in the form of small cup-shaped, dry, yellow crusts, made up of fungus spores and threads, each cup containing a hair in its centre, and somewhat resembling a piece of honeycomb—hence its name; it is contagious. The parasitic plant, causing or accompanying it is the *Achorion Schönleinii.*

Tinea Tonsurans, or vulgarly ringworm, is a chronic contagious disease, known by the dryness and brittleness of the hairs, which are broken off close to the scalp, and look as if nibbled off, the scaly eruption, and the roundness of the diseased patches. The parasitic plant is the *Trichophyton tonsurans.*

Tinea Kerion is tinea tonsurans, in which the follicles are very distinct, and give out a viscid discharge in consequence of the inflammation of the sebaceous glands and hair follicles conjointly.

Tinea Circinata is the ordinary ringworm of the body, the fungus is the trichophyton; it occurs in circular red patches that look like a herpes sometimes, at other times a pityriasis. All itchy, red, scurfy, circular patches should be examined for a fungus; thin layers of epithelium only being taken.

Tinea Sycosis is characterized by inflammation of the hair-follicles, causing successive eruptions of small acuminated pustules, occurring most frequently upon the chin and other parts occupied by the beard: it rarely occurs upon the scalp, and rarely affects women. The disease is either due to, or is attended by, the development of a microscopic parasitic plant—the *Microsporon mentagrophytes.*

Tinea Decalvans, is readily diagnosed by the perfectly smooth bald patches which result from the hair falling off on one or more circular spots, these spots varying in size from a sixpenny piece to five or six inches in circumference. The parasitic vegetable is *Microsporon Audouini.*

Tinea Vesicular, or Chloasma, makes its appearance gradually on the front of the chest or abdomen, in the form of small spots of a dull reddish color, which gradually increase in size, and assume a yellow tint. It may last from a few days to many months or years. It is contagious. According to Eichstedt, this disease is caused by a cryptogamic plant—*Microsporon furfur.*

Tinea tarsi seems to be parasitic sometimes.

Madura foot is not seen in England.

In Onychomycosis, the nails are rendered opaque, dry, and brittle by the attack of a vegetable parasite.

The only disease dependent upon the presence of animal parasites which we shall notice are scabies or itch, and prurigo pedicularis.

Scabies or itch is the chief animal parasitic disease, and it is due to the presence of the acarus scabiei, and is a contagious disease—contagious in that sense which implies contact—consisting of a vesicular eruption, presenting a number of watery heads, more or less distinct from each other, and attended with violent itching. From the vesicles runs a furrow, in the end of which the acarus lies, and is visible oftentimes as a white speck. This furrow or cuniculus is diagnostic. Scabies may attack any part of the body, with the exception of the head and face; it most frequently occurs in the flexures of the joints, especially betwixt the fingers, and around the end of the wrists, the front of the arm, the belly, and upper line of the penis.

The result of the irritation of the acari and the scratching is to induce other forms of eruptions, such as lichen and ecthyma, hence scabies is usually multiform.

"The following are the diagnostic points in scabies, but the only really conclusive proof of its existence in ordinary cases is the discovery of the furrow and its acarus:

"1. Absence of febrile disturbance.

"2. Absence of rash from the face and head (this is the rule); its absence from the posterior surface of the arm or body.

"3. The seat of the eruption: where the cuticle is thin —as for instance, the interdigital spaces, the anterior surface of forearm, front of the body below the nipple-level, about the mamma of women, along the front of the penis in men; in the seats of pressure—as for instance, about the groin when trusses are worn, over the ischia, and about the inner line of the wrist, forming a semicircle; in children—the buttocks, the feet, especially the inner line of the sole of the foot, and the palmar surface of the hands.

"4. The isolation of the vesicles, and their pointed shape.

"5. The *multiformity* of the eruption—namely, the intermingling of papules, vesicles, pustules, scabs, and even small ulcers.

"6. The itching at night, and the peculiar linear scratches made with the nails and fringed with dried blood.

"7. The cuniculus or furrow—in pustular scabies few.

"8. The evidence of contagion, or the existence of the same sort of disease in one house or family. It is in children that the greatest mistakes are made, simply from the want of knowing that scabies does not prefer their hands and arms, but their feet and their buttocks.

"9. The presence of acari amongst crusts, detectable by the microscope."[1]

Prurigo pedicularis.—Pediculi often occur in connection with a pruriginous eruption in old persons, especially amongst the lower orders and those who are badly nourished or uncleanly; but they are very rarely observed amongst the better classes. Prurigo may exist without them, and hence they cannot be regarded as its true cause, though they act the part of local irritants, exciting even and always intensifying the pruriginous disease. When destroyed, therefore, the prurigo frequently gets rapidly well, especially if they have excited the eruption. Pediculi when present certainly give rise to one special feature, producing so-called "bites." The true cause of prurigo is to be found in the malnutrition of the skin which exists, and which readily shows itself by eruption under irritation. Pediculi are best found in the folds, at the seams, of linen worn in contact with the neighborhood of the axillæ.

The Editor ventures to refer the reader for fuller information on all that relates to skin affections, to his Manual of Skin Diseases, recently published.

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[1] "Skin Diseases." By Tilbury Fox, M.D. Second edition, pp. 308–9.

CHAPTER XIII.

PARASITES FOUND IN THE HUMAN BODY.

In considering the parasites of the human body it is necessary to divide them into classes—according as they are of animal or vegetable nature, and according to the localities in which they occur—internal and external. The animal parasites alone will be described here, the vegetable parasites are considered in connection with skin diseases. The following is a list of internal animal parasites or Entozoa, and in the arrangement of them we follow Dr. Cobbold.[1]

There are: (1) cestoid worms or cestodes, or the tape-worms, and they are eight in number; (2) the larval cestodes, including five varieties; (3) nematodes or round worms, nine in number; (4) larval nematodes, three varieties; (5) trematodes or fluke-worms, five in number; (6) larval and doubtful nematodes, four in number; (7) acarine parasites, or pentastomes, two in number; (8) monads and bacteria.

CESTOID WORMS OR TAPE-WORMS.

1. **The Tænia Solium** has generally been regarded as the common tape-worm of this country; but it is not so, for the tænia mediocanellata is the most common. It exists in the small intestines, varying in length from five to ten or even thirty feet, and in breadth from one line—at its narrowest part—to four or five at its central or broadest portion. The head of this parasite is small and flattened, about the size of a pin's head, having in its centre a projecting papilla or proboscis, armed with a double circle of hooks, about twenty-four or twenty-eight in all, around which are four suckers or discs. The worm, in consequence of the presence of hooks, is often described as the armed tape-worm. There is a neck, joining head and body, and it is about half an inch long. The generative apparatus is found after the 450th seg-

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[1] "Tape-worms and Thread-worms (Human Entozoa)." Longmans. 1867.

ment, and consists of a ramified canal or ovarium containing the ova, and occupying the centre of each joint. The joints are called "proglottides," and they are capable of an independent existence when well formed. Their number is often 1200 in all, including perfect and imperfect. This tape-worm is the mature form of the cysticercus cellulosæ or pork "measle." The symptoms of its presence are not very striking, its existence being generally unsuspected until single joints are passed in the stools; in many cases, however, there is a continual craving for food, debility, pain in the stomach, emaciation, and itching about the nose and anus.

2. **Tænia Mediocanellata**, the unarmed or beef tape-worm, is the most common in the human body. Dr. Cobbold has shown this. And, whereas, the source of the tænia solium or armed tape-worm is undoubtedly measly pork, this species of tape-worm is the mature form of the beef and veal "measle," or cysticercus bovis. The unarmed is somewhat larger than the armed variety, and, as its name implies, is unfurnished with hooks around its head, and there is no prominent papilla or proboscis, but only a disc. It gives rise to the same symptoms as the last-mentioned.

3. **Bothriocephalus Latus**, or the broad tape-worm, is almost peculiar to the inhabitants of Switzerland, Sweden, Russia, and Poland, and it is met with in Ireland. It differs from the common tapeworm in having its segments of a greater breadth than length, and very numerous. It may be twenty-five feet long; it is slightly brownish, and its reproductive apertures are situated not at the margins, as is usual, but in the centre of the joints (ventral surface). The joints do not come away in any amount. The head is "somewhat flattened from before backwards, having two long, slit-like depressions at the sides, which by means of muscular action afford a tolerably efficient anchorage." (Cobbold.) The extreme fertility of the *bothriocephalus latus* may be understood by considering that each foot of the well-developed worm contains 150 segments or joints, each joint possessing its own ovary and male organs. Hence each joint is fertile, and as each ovary would produce 8000 ova, it may be calculated that ten feet of such a worm would produce 12,000,000 of ova. The worm is very rarely met with in this country, but it is so occasionally. Professor Owen, examining the collection of a worm doctor in

Longacre, found three specimens; two had come from persons who had been in Switzerland, but of the third nothing was known. The larva is *supposed* to develop in some fresh-water fish, salmon or trout, but it is not known.

4. **Bothriocephalus Cordatus** is a small worm not more than a foot long; like the last species in type, it has the reproductive apertures in the centre of the joints, "and a heart-shaped head whose apex is directed forward" (Cobbold). It is found in North Greenland.

5. **Tænia Elliptica**, a small worm, seen in the cat, with two sets of reproductive organs in each full-grown joint. Very rarely seen in man.

6. **Tænia Nana or Ægyptica**, worms resembling little threads an inch long, with an armed head, and found once in cerebral inflammation by Bilharz, of Cairo, in a boy there.

7. **Tænia Lophosoma** (Cobbold), the crested tape-worm. A solitary specimen eight feet long, characterized by a ridge all along the body, is to be seen in the museum of Middlesex Hospital. Dr. Cobbold thinks it may come from mutton "measles."

8. **Tænia Flavopuncta** (the spotted tape-worm), a worm eight or ten inches long, found in the United States in an infant, the joints having a yellow spot in their middle line.

The reader will observe that the three first-named varieties are alone of any importance.

LARVAL CESTODES, OR LARVÆ OF TAPE-WORMS.

All the tape-worms have their own special larvæ, which are developed in bodies other than those in which the mature tape-worms are found. Some of these larvæ are unknown at present. Four, however, are well-known, and these will now be described.

1. **Acephalocysts or Hydatids.**—These peculiar parasites are met with in different parts of the body, but especially in the liver, lung, brain, spleen, kidneys, and omentum.

Hydatid tumors occur in the liver more frequently than in any other organ. They consist of an outer fibrous sac, lined by a thin cyst of variable size, having the aspect of boiled white of egg, made up of layers, and filled with a limpid, colorless fluid, and floating in which are numerous small secondary cysts, similar to the cyst lining the sac, and varying in size from a pea to a pigeon's egg. To these cysts or bladders, Laennec gave the name acephalocyst—a bladder without a head. Sometimes the parent cyst contains no floating hydatids, or very few; in other cases it is literally crammed with them; and these again, it is said, may contain another generation. According to the character and mode of growth, exogenous, endogenous, and multilocular cysts have been described. When a secondary cyst or the "acephalocyst" is opened, its inner surface is seen to be studded with numerous white, opaque particles, which are found by the microscope to be distinct echinococci.

The *echinococcus hominis* is a transparent colorless, oval-shaped animalcule, just visible to the naked eye, displaying a head with suctorial prominences and a double, not however well-defined, row of hooklets at the extremity, and measuring about the one two-hundredth of an inch in length, and rather less in breadth. In structure the animal is a mere integument, one half—the head and neck—being susceptible of retraction into the other half. The head is a flat disc at the extremity of the neck, having imbedded in its substance an apparatus of small hooks, thirty-four in number, disposed in a circle. Immediately behind the head are four rounded suctorial processes, beyond which follows the body, while at the extremity of this is a short peduncle by which the animal attaches itself to the wall of the acephalocyst. When the animal is viewed with its head retracted within its body, the circle of hooks is seen through the transparent integument, appearing like a ring in the centre of the body.

The echinococcus is now known to be the larval form of the tænia echinococcus of the dog and wolf. In Iceland hydatid disease is abundantly common.

2. **The Cysticercus Cellulosæ**, or the Pork Measle.—This parasite is for the most part found in subjects of the leuco-phlegmatic temperament, but it is not common. It has been met with in the muscles—especially the glutei and extensors of the thigh, in the muscular tissue of the heart, and in the brain and eye. It is generally surrounded by an adventitious capsule formed of the neighboring tissue condensed by inflammation; it consists of a head, neck, and dilated cyst-like body, and varies in length from a quarter to three-quarters of an inch. It is

very commonly found in the hog, giving rise to that state of the muscles known as "measly pork."

[**Cysticercus Bovis**, or the Beef Measle.—The larva of the tænia mediocanellata is much smaller than that of pork, being about the size of a pea, but its head is larger, and it is *unarmed*. It does not occur in man.]

3. **Cysticercus Tenuicollis** is the larva of the tænia marginata of the dog: only two cases are on record in which it has occurred in man.

4. **Cysticercus Acanthotrias**, a larva with three rows of hooks, found in the dura mater and muscles of a woman in Virginia. It is doubtful what its mature form is.

The only larvæ of importance to be remembered are the three first.

NEMATODES OR ROUND-WORMS.

These consist of mature and larval forms, as do the cestoid worms.

1. **Trichina Spiralis** infests the pig, and man, in eating raw sausages and the like, transfers the parasite to himself. The trichina makes its way to the muscles, and there becomes encysted, giving the muscles a speckled appearance.

2. **Oxyuris Vermicularis**, or, as it has been usually called up to the present time, the *Ascaris Vermicularis*, or small thread-worm,—the males being one-sixth of an inch, the females nearly half an inch long,—is found in the rectum, and is the smallest of the intestinal worms. It gives rise to intolerable itching and irritation about the anus, tenesmus, depraved appetite, picking of the nose, disordered breath, and disturbed sleep.

3. **The Ascaris Lumbricoides**, or large round-worm, is found in the small intestines, especially of ill-fed children. It somewhat resembles in size the common earthworm, varies in length from six to nine inches, and is of a light yellow color. The symptoms which it gives rise to are thirst, disturbed sleep with grinding of the teeth, pallid countenance, fetid breath, swelled belly, emaciated extremities, depraved appetite, slimy stools, itching of the nose, tenesmus, and itching of the anus.

4. **Ascaris Mystax**, common in the cat, has been observed in man only very rarely.

5. **Tricocephalus Dispar**, or the long thread-worm,

is usually found in the cæcum and large intestines, measuring about two inches in length, and having a very slender body. It is often found in considerable numbers, even in the intestines of healthy persons, in Egypt, Ethiopia, France, and England: during life it gives rise to no symptoms.

6. **Strongylus Gigas**, or kidney strongle, sometimes occupies the human kidney. It is one of the largest of the parasitic worms, varying in length from five inches to a yard, and being sometimes half an inch in diameter. The male is smaller than the female. This worm causes great suffering: there are no symptoms of its presence that can be relied upon. It has been passed by the urethra, and the patient recovered.

7. **Strongylus Quadridentatus**, or Sclerostoma duodenale, about one-third of an inch long, infests the duodenum, causing anæmia. It is rare in England, common in Egypt and Italy.

8. **Filaria Bronchialis** is a slender worm about an inch in length. It was detected by Treutler in an enlarged bronchial gland of a patient who died from phthisis.

9. **Filaria Medinensis**, or the Guinea-worm, has its residence in the subcutaneous areolar tissue, and generally in that of the feet, though it may occur in any superficial situation. It is a long, slender, uniformly shaped worm, resembling a fiddle-string, varying in length from six inches to eight or even twelve feet, and being about one line in thickness. It appears to be endemic in the tropical regions of Asia and Africa. The symptoms of its presence are great uneasiness and itching, and ultimately suppuration.

Only 1, 2, 3, and 9 are of any importance.

LARVAL NEMATODES.

1. **Dracunculus loa.**

2. The **Filaria Oculi** was detected by Nordman in the liquor Morgagni of the capsule of the crystalline lens of a man who had been operated upon for cataract; it was curled up in the form of a ring, and measured three-fourths of a line in length. A larger species is found in the eye of the horse. It gives rise to no symptoms.

3. **Filaria Trachealis**, the Nematoideum tracheale of Bristowe and Rainey.

These are unimportant.

TREMATODES, OR FLUKE-WORMS.

1. **Distoma Hepaticum**, or Fasciola hepatica, or fluke, or liver-fluke, is found in the gall-bladder and ducts of the liver of a variety of quadrupeds, and especially in the sheep in connection with the disease called "the rot." When it occurs in man it is generally developed in the same situation. It has been found beneath the skin of the sole of the foot. In form it is flattened, ovate, and elongated; its under surface presents three pores, the anterior being the mouth, the middle being for the purpose of generation, and the posterior for adhesion or locomotion; and it is of a light brown color. The flukes give rise to no characteristic symptoms.

2. **Distoma Lanceolatum** is another species of distoma, which is found in the gall-bladder. It is a small worm, flat, about one-third of an inch in length and a line or more in breadth.

3. **Distoma Hæmatobium.**—The Egyptian fluke, the cause of endemic hæmaturia. It is a white worm, not an inch long; it infests the portal veins and those of the urinary organs. In the Cape hæmaturia, the ova only have been discovered; they are $\frac{1}{170}$th of an inch in length by $\frac{1}{400}$th broad, and pointed at the end.

4. **Distoma Crassum** (Busk) was found in the duodenum in a single case by Mr. Busk. The worm was from $1\frac{1}{2}$ to 3 inches, and $\frac{5}{8}$ inch broad.

5. **Distoma Heterophyes** (Siebold) was found by Bilharz in the small intestine of a boy. The worm is three-fourths of a line in length, and a quarter of a line broad.

No. 1 and 3 alone are important.

LARVAL OR DOUBTFUL TREMATODES.

1. **Tetrastoma Renale** (Delle Chiaje).—This is described as infesting the kidney; it is said to be five lines in length, or so, to have an oval and flat body, with four suckers disposed in a quadrate manner at the caudal extremity. The reproductive orifices are situated near the mouth.

2. **The Polystoma, or Hexathyridium, Pinguicola** was originally discovered by Treutler in the cavity of a mass of tubercle in the left ovarium of a young woman who died in labor. It is about three-quarters of an inch

in length, truncated towards the head, and pointed towards the other extremity.

3. **Polystoma, or Hexathyridium, Venarum** occurs in the veins rarely. It "attains a length of three lines, is cylindro-lanceolate in shape, its six suckers being biserially disposed on the under side of the so-called head" (Cobbold).

Distoma Ophthalmobium (Diesing), is a small worm about one-eightieth of an inch long, which occurs beneath the capsule of the lens of the eye, but it is an immature form.

These are the true entozoa found in man. There are certain other parasites—ex., two species of acarine parasites (Pentastomes) occasionally observed.

[Then there are false entozoa, one is the Nematoideum hominis, which is the common hair-worm or *Gordius Aquaticus*, another *Dactylius Aculeatus*, first described by Mr. Curling, who discovered several of them in the urine of a little girl recovering from fever. The worm is of a light color, cylindrical, and about four-fifths of an inch long. A third, *Diplosoma Crenatum*, varies in length from four to six or eight inches, is solid throughout, without any trace of internal organization, and of a yellow-white color. A patient of Mr. Lawrence's voided numbers of these parasites for a length of time from the urinary bladder; they were probably contained in a cyst which was ruptured by passing a catheter. A fourth, *Spiroptera Hominis*. This worm was first discovered in the urine of Mr. Lawrence's patient just alluded to. Rudolphi examined some specimens which were forwarded to him, and found them to be of different sexes—the female ten lines in length, the male about eight—of a white color, slender, and very elastic. It is the common Filaria of fishes.

Various monads are found in the body: *The Trichomonas Vaginalis* in the vagina; *Cercomonas Saltans*, or leaping monad; *Cercomonas Urinarius*, or urinary monad; *Cercomonas Hominis*, which is intestinal; *Bacteria* in the blood, and the *psorosperms* found in muscle supposed to be the eggs of distoma hepaticum.]

If we arrange the more commonly occurring Entozoa according to the organ affected, we have the following list:

Internal Animal Parasitic Worms.

Brain, . . .	Cysticercus cellulosæ.
Eye, . . .	Filaria oculi. Cysticercus cellulosæ.
Liver, . . .	Acephalocystis, or hydatid. Echinococcus hominis.
Gall-bladder, . .	Distoma hepaticum, or liver-fluke, more properly fasciola hepatica.
Spleen and Omentum,	Echinococcus hominis.
Kidney, . . .	Strongylus gigas. Distoma hæmatobium.
Ovary, . . .	Polystoma pinguicola.
Small Intestines, .	Ascaris lumbricoides, or round-worm. Tænia solium. Tænia mediocanellata. Bothriocephalus latus, or broad tape-worm.
Large Intestines, .	Tricocephalus dispar, or long thread-worm. Ascaris, or Oxyuris vermicularis, or common thread-worm.
Areolar Tissue, .	Filaria Medinensis, or Guinea-worm.
Muscular Tissue, .	Trichina spiralis. Cysticercus cellulosæ.
Bronchial Glands, .	Filaria bronchialis.

EXTERNAL ANIMAL PARASITES.

Pulex Penetrans, or the Chigoe.—This small insect is found in America and the Antilles; it penetrates the epidermis, and there lodges its eggs to about the number of sixty, which, when hatched, create great irritation, and often serious mischief. The native inhabitants extract them very skilfully with a needle, taking care not to rupture the cyst in which they are inclosed.

The Acarus Scabiei.—This little parasite, belonging to the class *Arachnida* (spiders) of articulated animals, is the cause of scabies, or itch. The male is but one-third the size of the female; he is the more nimble of the two, being very lively when the body is warm; and he is the least frequently met with. He has suckers on the inner two of his four hind feet, and genital organs on the surface of the abdomen. The female burrows into the epidermis, and lays her eggs, shifting her position in the meantime, until from sixteen to thirty or more eggs are inserted beneath the skin. In ten days the shells are broken, and the insects make their appearance as six-legged larvæ, increase rapidly in size for a few days, then shed the cell—like the crustacea—and acquire eight legs, when they are perfectly developed, and capable of tormenting man and reproducing their species. The young females do not burrow into the epidermis as the pregnant females do, but run about on the surface till they are impregnated, then they burrow.

The Acarus Folliculorum.—The acarus folliculorum, or the steatozoon folliculorum, was discovered by Dr. Simon, of Berlin, in the sebaceous substance with which the hair-follicles—especially those on the face—are commonly filled. It is very minute in size, measuring little more than a quarter of a line in length, and being undistinguishable by the naked eye; it is divisible into a head, thorax, and abdomen, and resembles in form and shape the common caterpillar. This animalcule is found in numbers varying from one to twenty in the sebaceous follicles or oil-tubes of the skin in the majority of mankind, and always when any disposition exists to the unnatural accumulation of sebaceous matter: the skin at the same time is apparently healthy. They may be obtained by compressing the skin until the sebaceous matter is squeezed out: a microscope magnifying 250 diameters will detect them.

Pediculi.—The human body is infested with four different species of the pediculus or louse—of which the *pediculus capitis*, or louse of the head, is the most common; next, the *pediculus pubis*, or crab-louse, which attaches itself to the hair about the pubes and anus; the *pediculus corporis*, or body louse, often found in the clothes; and lastly, the *pediculus ciliorum*, or louse of the eyelash, which is very rare.

The list of the more common epizoa, as external animal parasites are called, will therefore be as follows:

External Animal Parasites.

Skin, ...	Pulex penetrans or chigoe. Acarus Scabiei.
Hair-follicles, . . .	Acarus folliculorum.
Surface of the Body, .	Pediculus corporis.
Hair of the Head, . .	Pediculus capitis.
Hair of the Pubes, . .	Pediculus pubis.
Eyelashes, . . .	Pediculus ciliorum.

CHAPTER XIV.

ON THE CHEMICAL AND MICROSCOPICAL EXAMINATION OF THE BLOOD, EXPECTORATION, VOMITED MATTERS, AND URINE.

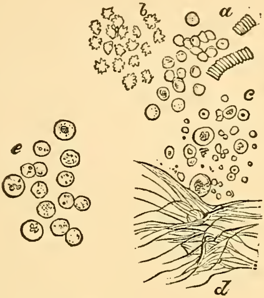
SECTION I.

THE BLOOD.

On removing blood from the vessels, and allowing it to repose for a short time, it coagulates—that is to say, the liquor sanguinis separates into two portions: the colored clot or crassamentum—consisting of the fibrin and blood-corpuscles—and the fluid portion, consisting of the serum holding the albuminous and saline matters in solution. The formation of the clot is owing to the solidification of the fibrin, which, while becoming solid, entangles the red and white blood-corpuscles in its meshes. In certain states of the system, when the fibrin coagulates more slowly, or when the corpuscles sink more rapidly than in healthy blood, the upper surface of the clot will be colorless, presenting an appearance known as "the buffy coat," which was formerly thought to be indicative of inflammation. Occasionally this buffy coat, when the blood is rich in fibrin, is depressed in its centre, and the blood is then said to be "cupped and buffed."

Microscopic Examination of the Blood.—If a drop of blood be placed under the microscope, and examined with a quarter of an inch object-glass, the red globules will be seen as a multitude of pale, red, round, bi-concave discs, having a tendency to join (see Fig. 7, *a*), and to arrange themselves in rolls like rouleaux of coins; a very few white corpuscles, in health 1 to 300 or 400 corpuscles, irregular in form, granular on the surface, and rather larger than the red globules, will also be readily distinguished. Long maceration in serum or in water will frequently cause the red globules to diminish to half their size in bulk, and to present a perfectly spherical, slightly colored body. Strong acetic acid dissolves them rapidly. Acetic acid renders the external cell-wall of the colorless corpuscles very transparent, and also brings the nucleus into view, consisting of one or two round granules. In leucocythæmia — as described by Dr. Hughes Bennett—the colorless corpuscles become much increased in quantity, so that, instead of two or three being seen in the field of the microscope at the same time, some thirty, forty, or more become visible.

FIG. 7.



a. Blood-discs, as usually seen.
b. Blood-discs, altered in shape.
c. Tubercle corpuscles.
d. Lung-tissue, on expectoration.
e. Pus corpuscles.

In cases of cholera very large cells, like the white blood-cells, but larger, are seen. Dr. Beale has detected in the blood current "a number of masses of germinal matter, and products resulting from their death and decay . . . and there is reason for thinking that these particles have obtained entrance from without and made their way through the thin capillary walls, and thus become mixed with the circulating fluid." The congestion of the capillaries, induced by the little mass that became impacted in them leads to "eruptions" and "rashes," Dr. Beale thinks, and he has worked out this question, especially in relation to cholera and cattle plague. Recently, Dr. Bastian and others abroad have observed that in acute inflammatory diseases of a general character the white cells are not only increased but cohere, and become obstructed in the minute capillaries, and Dr. Bastian thinks this may be the cause of delirium when the brain capillaries are affected.

To Examine Stains of Blood.—To discover whether a certain stain consists of blood, it must be moistened with some fluid having a specific gravity of 1040 or 1050—white of egg will answer very well—scraped off the material holding it, and examined microscopically with a quarter of an inch object-glass; blood-corpuscles will be rendered distinctly visible if the stain consists of blood. The blood solution may also be recognized by the spectroscope by the dark bands in the green position of the spectrum. Recently Dr. Day, of Geelong, has given another mode.

It is a simple test, and one easy of application, and consists in the addition of tincture of guaiacum and "ozonized ether" to a weak solution of blood, when a bright blue color is produced. If a drop of blood be mixed with half an ounce of distilled water, and a drop or two of guaiacum be added, a cloudy precipitate of the resin is thrown down; and the solution has a faint tint, due to the quantity of the tincture used. If now a drop of an ethereal solution of peroxide of hydrogen be added, a blue tint will appear, which will gradually deepen and spread after a few minutes' exposure to the air. This test acts better when very small quantities of blood are used; as otherwise, if the blood is in excess, the solution is red, and gives, with antozone, a purplish or dirty green color. So minute and delicate is the reaction, that, in a case where the microscope failed to identify any blood from a stain in a man's trousers, Dr. Day succeeded in obtaining sixty impressions.

Black currants will cause a stain resembling that of blood more than any other; but antozone has no effect upon it.

Ink-stains will cause a blue with guaiacum; so will rust-stains produced by citric or acetic acid on iron; but then *no* "ozonized ether" need be used, and this at once distinguishes such stains from blood. "Ozonized ether" is a wrong term to use; for it contains antozone, and not ozone; and to this is due its reaction. Ether which contained an ozonide would blue guaiacum resin, whether blood were present or not. The test-solution is the ethereal solution of peroxide of hydrogen, which is an antozonide.

The so-called "ozonized essential oils," as oil of turpentine, lavender, &c., really contain antozone; and to this may be ascribed their use in detecting blood; for at first oil of turpentine was used, instead of the peroxide of hydrogen; but the results were unsatisfactory.

If the blood-stain be on dark cloth, the test, as above described, may be used; but then an impression must be taken off on white blotting-paper, otherwise the blue color will not be visible.

The exact nature of the chemical change that takes place is doubtful; but the test is so simple and easy of application, and above all, so very delicate, that it is likely to become very generally used. This test fails, as other tests have failed before, to show whether the blood stain is human or not. The microscope will point out whether a corpuscle comes from a fish, a reptile, or a mammal.[1]

Dr. Garrod's Plan of ascertaining the Presence of an Abnormal Quantity of Uric Acid in the Serum of the Blood.—Take from one to two fluid drachms of the serum of the blood, and put it into a flattened glass dish or capsule; to this add the strong acetic acid of the London Pharmacopœia, in the proportion of about six minims to each fluid drachm of the serum. A few bubbles of gas are generally evolved at first; but when the fluids are well mixed, two or three fine threads, or one or two ultimate fibres from a piece of unwashed huckaback, are to be introduced. The glass is then to be put aside in a moderately warm place—as on the mantelpiece in a room of ordinary temperature—until the serum is quite set and almost dry, the time required varying from eighteen to forty-eight hours. If the cotton fibres be then removed and examined microscopically with an inch object-glass, they will be found covered with crystals of uric acid, if this agent be present in abnormal quantity in the serum. The crystals form on the thread, somewhat like the crystals of sugar-candy on string. See Fig. 8.

When it is undesirable to remove even a few drachms of blood, we may examine the fluid effused by the application of a blister, since the uric-acid thread experiment may be as readily employed for the discovery of uric acid in blister-serum as in blood-serum. It is only necessary to observe the precautions alluded to in examining the blood-serum, and also to be careful not to apply the blister to an inflamed part, since the existence of inflammation appears to have the power of preventing the appearance of uric acid in the effused serum.[1]

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[1] British Medical Journal, Sept. 5, 1868.

SECTION II.

THE EXPECTORATION.

The character of the expectoration often furnishes us with instructive signs. The basis of all kinds of expectoration is the natural secretion of the mucous membrane of the air-tubes, which is a transparent, colorless, glutinous liquid, consisting chiefly of water, mucus, and saline matter. In simple catarrh the natural secretion is merely increased in quantity; in bronchitis the sputa are often glairy—like white of egg—and streaked with blood; in hæmoptysis the expectoration may consist entirely of blood; in phthisis, purulent fluid and portions of softened tubercle are expectorated, occasionally with cretaceous or calcareous masses of phosphate and carbonate of lime; while in pneumonia, at the outset, there is merely expectoration of bronchial mucus, but in two or three days the sputa assume a very characteristic appearance, being transparent, tawny or rust-colored, and united into a jelly-like mass of great viscidity.

To examine the sputa microscopically, it is directed by some that they should be thrown into water, when the lighter portions will float on the surface, while the more dense sink. These latter can then be broken up, and small particles placed on a glass slide for examination. Dr. Beale prefers to remove small pieces from the vessel on to the glass slide at once. The matters usually found consist of epithelium, portions of food—as muscular fibre, oil-globules, fibres of various kinds, starch granules, &c. —and occasionally of vegetable fungi, which are often present about the fauces. In catarrh, the mucous corpuscles are augmented in number with masses of oil-globules, and granular cells very like pus corpuscles. In pneumonia, the sputa are made up of inflammatory corpuscles, blood-cells more or less changed, and *débris* of various kinds. The sputum of bronchitis is purulent.

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[1] "Medico-Chirurgical Transactions," vol. xxxvii, p. 51.

Miners expectorate particles of carbon in their sputa which are unaffected by boiling in strong acids. In phthisis, a number of small, round, oval, or triangular-shaped bodies—*tubercle-corpuscles*—are frequently found, containing granules in their interior, and mingled with granular matter. Occasionally fine molecular fibres, which have been separated from the areolar and elastic tissues of the air-cells of the lung, are also seen, showing that ulceration or sloughing of the pulmonary texture is going on. See Fig. 7, *d*. To detect lung-tissue, the plan of Dr. Fenwick may be followed : Shake up the expectoration with an equal quantity of solution of caustic soda (20 grains to an ounce of water) and boil it in a glass beaker. As soon as it boils it becomes liquid ; pour it into a conical glass and add four or five times the quantity of cold distilled water. The lung-tissue, if present, will sink to the bottom of the glass, and can be readily removed by a dipping-tube and examined with the microscope. In pneumonia, fibrinous casts of the minute bronchi may often be observed, sometimes infiltrated with pus corpuscles. And lastly, the dirty green or black inspissated sputum, so commonly expectorated in the morning by residents in cities, consists of mucous and epithelial cells containing carbon, probably derived from the smoky atmosphere. Hydatids are rarely found.

SECTION III.

VOMITED MATTERS.

But little attention has been paid to the microscopic examination of these matters. The chief substances found are epithelium, starch-granules, torulæ and other varieties of vegetable fungi—resembling the yeast plant, vibriones, and sarcinæ.

The *Sarcinæ Ventriculi*—first described by Goodsir—consist of square bundles, divided by vertical and horizontal lines into four parts, and each having a resemblance to a woolpack—whence its name ; they are seen either singly or aggregated into masses. These vegetable parasites are found in the vomit when it is very acid, and when it resembles yeast in appearance.

Sarcinæ are chiefly found in connection with pyloric obstruction. They have also been found in the urine, fæces, and in the fluid of the ventricles of the brain.

In "coffee-ground vomit," blood-cells and altered hæmatin are found; "bilious" vomit contains epithelial cells, biliary coloring matter, and fat globules. In cancer of the stomach, characteristic cells may be detected.

SECTION IV.

THE URINE.

Healthy human urine is a limpid, pale, amber-colored fluid, free from any deposit, of acid reaction, unaffected by heat, nitric acid, liquor potassæ, &c., and having an average specific gravity of 1018 to 1022. Dr. Prout estimates the normal quantity of urine secreted in the twenty-four hours to be from thirty ounces in the summer, to forty in the winter—the average is about forty ounces. A distinction is usually drawn between the *urina potus*, or that passed shortly after taking fluids; the *urina chyli*, or that evacuated soon after the digestion of a full meal; and the *urina sanguinis*, or that which is voided on first awaking in the morning, and which may generally be taken as a fair specimen of the renal secretion. The *urina chyli* contains twelve or thirteen times as much urea, fifteen or sixteen times as much uric acid, and four times as much salts as the *urina potus*. It is also alkaline. Hence the importance of collecting and mixing all the urine passed in twenty-four hours for examination. The solid matters in the urine may be said to consist of urea, uric acid, hippuric acid, vesical mucus, and epithelium, ammoniacal salts, fixed alkaline salts, earthy salts, and animal extractive.

The amount of urea passed in the twenty-four hours should be about one ounce. After standing a little time urine becomes cloudy, carbonate of ammonia is evolved from the urea, and ammonio-magnesian phosphate is formed and floats with the mucus at the top of the fluid. If the decomposition proceeds, then triple phosphate and amorphous phosphate of lime form in addition.

The amounts of water and solid constituents vary much according to the age, sex, time of day, proximity to meals, the nature of the food, quantity of fluid taken, &c. The following is the average composition: Out of 1000 parts of urine 950 are water and 50 solid; the latter being made up of urea 25, uric acid 1, salts 14, organic matter 10 parts. The total solids got rid of in twenty-four hours amount to nearly 1½ ounces.

Clinical Examination of Urine.—On making a clinical examination of the urine, we should first ascertain the quantity passed in the twenty-four hours ; its acidity or alkalinity, by the use of litmus and turmeric papers ; its specific gravity, by means of the urinometer ; and its behavior on the application of heat, nitric acid, and liquor potassæ. To examine it microscopically a portion should be placed in a conical glass, and allowed to stand for some hours ; a few drops of the deposit at the bottom of the glass are then to be placed by means of a pipette on a glass slide, and covered with thin glass. Crystals of uric acid, deposits of urate of soda, and deposits of phosphates, will be readily distinguished with a good half-inch achromatic object-glass ; oxalate of lime, carbonate of lime, cystine, blood-corpuscles, casts of tubes, pus, mucus, epithelium, and certain fungi, as torulæ, &c., will require a quarter-inch object-glass ; while spermatozoa and vibriones can only be distinctly examined with the one-eighth of an inch glass. The urine should be examined soon after it has been passed because it soon decomposes, though it is well to re-examine at the end of some hours. Uric acid, for instance, is deposited after the urine has been standing some time, and it may not be detected when first passed. There are many foreign matters which find their way into the urine and must be carefully discriminated ; they are the hairs of various animals—ex., cats and dogs—fibres from cotton, blankets, flax ; starch granules, bread crumbs, bits of tea leaves, fibres of wood from the floor, human hair, oily matter from greased catheters, and various substances put into the vessel into which the urine is passed—ex., fruit. Dr. Beale points out that students may mistake the fibres of deal (with their "pores," characteristic of coniferæ, looking like epithelial cells) for casts.

Now the principal changes in the urine refer to its increased or diminished quantity, its altered reaction ; an increase or diminution in the normal constituents (the urea, uric acid, and salts), or the appearance in it of substances alien to it in health—ex., sugar, blood, casts of tubes, &c.

An Increased Flow of Urine, or diuresis, may be temporary, and merely dependent on the large quantities of fluid taken ; or it may be permanent for a time and associated with disease, as it very constantly is in diabetes, and in those states of the system connected with a peculiar state of nervous irritability—as hysteria, &c.

Deficiency of Urine may also be the temporary result of abstinence from fluids, unusual cutaneous activity, &c.; or it may be permanently associated with certain constitutional and local affections, as with inflammatory states of the system generally, in diarrhœa, cholera, by hemorrhage, dropsy, in inflammation of the kidney.

Reaction of the Urine to Litmus and Turmeric Test-papers.—In many diseases—as gout, rheumatic fever, &c.—we find the urine *unusually acid*, which may be owing to an excess of acid, or it may be caused by the presence of oxalic acid. On the other hand, this secretion may be *alkaline*, though it is very doubtful if the urine is ever so secreted. It generally happens thus: a patient is unable completely to empty his bladder, and therefore, after each attempt to do so, a small quantity of urine is left which soon becomes alkaline; this suffices to contaminate the acid urine as it drops *guttatim* from the ureters. Of course, as a rule, the vital endowments of the bladder are sufficient to preserve its contents from undergoing that change which so readily takes place out of the body—viz., decomposition. But this preservative power depends upon the integrity of the spinal nerves and branches from the organic system supplying this viscus; if, therefore, any injury be inflicted upon these nerves, directly or indirectly, the result will be diminution of vital power, and the urine will undergo certain changes, as it would out of the body. One of these changes is the union of urea with the elements of water, and the formation of carbonate of ammonia. Ammoniacal urine inflames the mucous membrane of the bladder, and gives rise to the secretion of mucus of a viscid character; the mucus becomes puriform when the alkaline urine has kept up the inflammation for a certain time.

Urinary deposits.—With regard to these, we may make a fair estimate of their nature by observation with the naked eye. Dr. Beale gives three classes:

1. Light and flocculent deposits, usually transparent and occupying considerable volume. These are composed of mucus, epithelial matters, spermatozoa, vibriones, fungi, casts of tubes, or matters of extraneous origin.

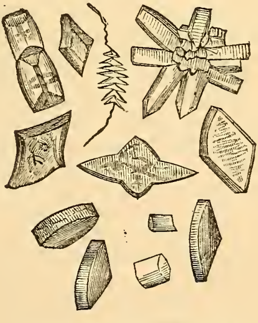
2. Dense and opaque deposits occupying considerable bulk, may be urate of soda (reddish-brown or yellowish),

pus, or phosphates (mostly whitish, the urine being neutral or alkaline).

3. Granular or crystalline deposits occupying a small bulk, sinking to the bottom or deposited on the sides of the vessel, may be uric acid (cayenne pepper, sand), oxalate of lime (rare), small quantities of triple phosphate (white), cystine, carbonate of lime (rare), blood corpuscles (urine smoky), with matters of extraneous origin.

Urine depositing Uric Acid—is very acid; of a reddish-brown color; generally of a specific gravity above 1020; and on cooling deposits crystals of uric acid resembling a yellow crystalline sand. They may be passed with the urine. This deposit does not dissolve on the application of heat; but if—as often happens—the urine contains an excess of urates, this excess will be dissolved, and hence the crystals of uric acid will become more distinct. Nitric acid dissolves the deposit, while hydrochloric and acetic acids have no action; heated with liquor potassæ, the uric-acid crystals dissolve, from the formation of urate of potass, which is readily soluble in alkaline fluid. Examined microscopically, large rhomboidal crystals are seen; occasionally lozenge-shaped and square crystals are present. The most characteristic appearance is the presence of a deposit which is made up of particles that look like "cayenne pepper grains," but the uric acid deposit may seem to be amorphous, and it may be of lightish color. See Fig. 8.

Fig. 8.



Uric acid in various forms.

Urine containing an Excess of Urea may be known by its high specific gravity—1020 to 1035—and by crystals of nitrate of urea forming on adding nitric acid to a portion of the urine in a test-tube. If the urea be only slightly in excess, the urine should be concentrated, by evaporation to about one-third its bulk, before adding the acid.

Quantitative Determination of Urea (after Liebig).—It is very important that the student should know how to carry out this investigation.

Urea is thrown down from its solution by mercuric nitrate (nitrate of mercury), and the precipitate so formed consists of four equivalents of mercuric oxide (oxide of mercury) to one equivalent of urea. On the knowledge of this fact the process for estimating urea quantitatively is based. But in order to arrive at accurate results, the urine subject to examination should first be freed from albumen, if it contain any, and from phosphates and sulphates. It is also necessary to make allowance for the chlorides which enter into its composition; for they, in presence of urea, prevent its combination with mercuric nitrate.

The mercuric nitrate added to the urine reacts first on the chlorides, breaking them up into sodic nitrate (nitrate of soda), potassic nitrate (nitrate of potash), and mercuric chloride (chloride of mercury), and then combines with urea, forming a white insoluble compound of the composition already mentioned. Should, however, more mercuric nitrate be added to the urine than just enough both to decompose all its chlorides and to combine with all its urea, then the excess will remain in solution; and to recognize its presence a solution of sodic carbonate (carbonate of soda) is required; for sodic carbonate strikes a yellow color, due to the liberation of the hydrated mercuric oxide (oxide of mercury) with mercuric nitrate. Thus the exact point is attained and just passed over as regards the precipitation of the urea, when the urine under examination, or any mixture containing urea, to which mercuric nitrate has been added, strikes a yellow color when brought into contact with a solution of sodic carbonate.

Three solutions then are necessary for the estimation of urea quantitatively—viz. (*a*) the mercuric nitrate; (*b*) the baryta (for phosphates and sulphates); and (*c*) the sodic carbonate solution.

(*a*) *Solution of mercuric nitrate.*

It is best prepared by the action of nitric acid on pure mercury.[1] The solution so formed is of such a strength that 20 c.c.[2] are just sufficient to precipitate all the urea in a solution containing 0.2 gramme[3] of urea; so that 1 c.c. of the solution corresponds to 0.01 gramme of urea. And 10 c.c. of it contain 0.772 gramme of mercuric nitrate.

(*b*) *The baryta solution* is made by mixing one volume of barytic nitrate (nitrate of baryta) with two volumes of baryta water, both prepared by cold saturation.

(*c*) *The solution of sodic carbonate* contains 1.3 grammes of the salt in 28.57 c.c. of the solution, or exactly 20 grs. in 1 oz.

Now for the steps of the analysis. Collect and mix all the urine passed in the twenty-four hours and measure its quantity. 1. If albumen be present in the urine, it must be got rid of as described in the following paragraph; if absent, we proceed at once with step No. 2.

Measure off 100 c.c. of the urine, and heat it for twenty or thirty minutes in a retort or Florence flask in a water-bath. At the end of that time the albumen will separate from it in thick flocculi. But if from want of free acid it should not do so, add to it, while still hot, a few drops of acetic acid (usually five drops are enough) and set it aside to cool. When cold, measure it again; and if from evaporation the urine with the coagula of albumen floating in it has decreased in quantity, add enough distilled water to bring it again to 100 c.c. Now pour the whole on a dry filter, and leave it for about eight or ten hours; at the end of that time all the urine will have run through, leaving the albumen on the filter.

2. Take next 40 c.c. of the filtered urine, and set the remainder aside, in case it may be necessary to repeat the part of the process about to be described. Now add 20 c.c. of the baryta solution to the 40 c.c. of urine, and pour the mixture on a dry filter in order to separate the precipitate of barytic phosphate and sulphate (phosphate and sulphate of baryta) formed. Of the clear filtrate thus obtained, measure off and put into a beaker 15 c.c., which will represent 10 c.c. of pure urine.

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[1] See a detailed account of the process in Neubauer and Vogel ("Sydenham Society's Translation," p. 181).

[2] 1000 cubic centimeters (1 litre) = 35 oz.

[3] 1 gramme = 15.432 grains.

3. Pour into the bottom of a clean white plate some of the solution of sodic carbonate before described, and keep it near at hand.

4. Fill a burette, graduated in cubic centimeters, with the mercury solution. Let it flow now guttatim into the beaker, into which the 15 c.c. of the mixture of urine and baryta water have been placed. The first few drops will cause no alteration in the mixture, but after a further addition it will become turbid. Remembering that the urine will become cloudy only after all the chlorides in it are decomposed, the observer must be careful to note the quantity of mercury solution employed to attain this point. Usually three or four cubic centimeters are enough for the purpose.

Let the mercury solution flow now more freely into the beaker, taking care to stir the mixture continually with a glass rod, and soon an abundant white precipitate will form, composed of urea, in combination with mercuric nitrate. In order now to ascertain the point of completion of this part of the analysis, drop by means of a glass rod, after every addition of the mercury solution, a drop of the mixture in the beaker into the plate wetted with the solution of sodic carbonate. On doing this, it will be found that the drop, which forms a white circle on the plate, will remain white as long as an inadequate quantity of mercuric nitrate has been added to the mixture; but the moment the limit of sufficiency is overstepped, a yellow color will develop itself at the margin of the white circle.

The moment the yellow tinge appears, add no more of the mercury solution; for it indicates that all the urea in the urine mixture is precipitated, and that there is in addition a small quantity of free mercuric nitrate in the solution.

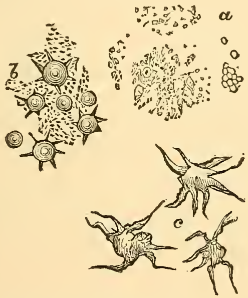
Note down the quantity of mercury solution used to reach this point, and proceed to calculations.

Supposing, for example, 29 c.c. of the mercury solution are employed in order to precipitate all the urea in the urine, and that 4 c.c. were used before all the chlorides in it were decomposed, then 25 c.c. will represent the actual quantity which entered into combination with the urea present in the urine.

Since 1 c.c. of the mercury solution corresponds to 0.01 gramme of urea, it is obvious that 0.25 gramme of urea is the amount present in the 10 c.c. of the urine that was used. Hence, also, 2.5 will represent in percentage the amount of urea in the urine examined. And from this the actual amount of urea secreted in the twenty-four hours can be determined, the urine made use of being part of what was collected in the twenty-four hours previously to the commencement of the analysis.

Urine containing an Excess of Urate (or Lithate) of Lime, Soda, &c., will be distinguished by its high color, increased density, and turbid appearance when cold—somewhat resembling pea-soup. On applying heat with a spirit-lamp, it immediately becomes bright and clear. Examined by the microscope, an abundant amorphous precipitate is seen. See Fig. 9, *a*, *b*, *c*.

Fig. 9.



a. Urate of ammonia.
b. Urate of soda (rare form).
c. Urate of soda (rare form).

These deposits were formerly regarded as consisting of urate of ammonia. It has, however, been lately shown that they have a variable constitution, being made up of urates of lime, magnesia, soda, with only very small quantities of ammonia. Even this last is probably derived from the decomposition of urea. Their color is pinkish or reddish-brown, sometimes whitish.

Urine containing an Excess of Ammoniacal and Fixed Alkaline Salts, is generally of a pale color, and rather low specific gravity. On the application of heat, a deposit is produced resembling albumen, but which is made up of phosphates, from which it is distinguished, however, by its being dissolved on the addition of a few drops of nitric acid. Sometimes, when the quantity of albumen present is small, the cloudiness produced by heat will be dissolved by a drop or two of nitric acid, but will reappear on continuing to add more of this agent; but the phosphatic cloud remains permanently dissolved. Liquor potassæ and liquor ammoniæ also produce deposits of phosphates. Examined with the microscope, crystals presenting the form of triangular prisms, sometimes truncated, at others having terminal facets, are readily distinguished; occasionally they present a star-like or foliaceous appearance. Altered pus, if the bladder be diseased, is also found. This urine contains in fact:

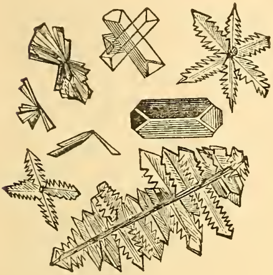
Phosphates.—These are soluble in acids; are thrown down by heat; occur in neutral or alkaline urine, and the addition of ammonia is followed by the formation of stellate crystals. We find the phosphates in the forms of ammonia, phosphate of magnesia, or the triple phosphate, which occurs as a slight deposit, or as a thin film on the surface, or a dense deposit. Secondly, ammonio-phosphate of magnesia, with an excess of ammonia, the bibasic phosphate, and lastly, phosphate of lime. In the first the crystals are prismatic with obliquely truncated ends, and the prisms may be triangular or quadrilateral. In the second form they are stellate and feathery. In the latter the particles are granular or radiate. See Fig. 10.

Cystine.—This substance never occurs in healthy urine, and rarely in diseased; it has been found especially in the renal secretion of scrofulous patients. It forms a fawn-colored deposit, somewhat resembling the pale urates, but which is unchanged by heat, and slowly dissolves on the addition of nitric or hydrochloric acid; it is readily soluble in liquor ammoniæ. A greasy-looking pellicle, consisting of crystals of cystine and ammonio-phosphate of magnesia, soon forms on cystic urine. When a few drops of an ammoniacal solution of cystine are allowed to evaporate spontaneously on a piece of glass, crystals in the form of six-sided laminæ will be seen by the microscope. See Fig. 11, *c*.

Oxalate of Lime.—Oxalate of lime is often present in the urine, and is a constituent of one of the most annoying forms of calculi. The urine is generally of a fine dark amber hue, of a specific gravity varying from 1015 to

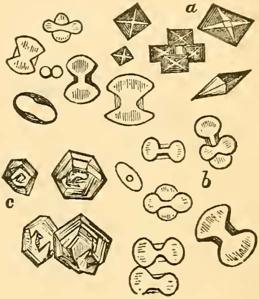
1025, natural in quantity, and free from any precipitate—unless there be also an excess of urates. The deposit is insoluble in liquor potassæ and acetic acid, but soluble in nitric acid. Examined by the microscope, crystals, in the form of transparent octahedra with sharply-defined edges and angles, will be detected; if the light be bright, these crystals generally resemble cubes marked with a cross. Very rarely, the crystals are shaped like dumb-bells, or like two kidneys with their concavities opposed, and are believed to be formed in the kidney itself. Crystals are also found in casts, and in mucus. See Fig. 11, *a*, *b*.

Fig. 10.



Common forms of ammonio-magnesian phosphates.

Fig. 11.



a. Oxalate of lime (octahedra).
b. Dumb-bell crystals of oxalate of lime.
c. Cystine.

Gravel in the Urine.—When a patient discharges gritty powder, or sand, or small calculi, with the urine, he is commonly said to have "a fit of the gravel." The most common forms of gravel are the urates of lime, potash, and soda, with a small quantity of ammonia, often called lithate or urate of ammonia. Next in frequency we find lithic or uric acid, or red sand; then a deposit, consisting mainly of the triple phosphate of ammonia and magnesia, mixed with amorphous phosphate of lime; next a deposit of oxalate of lime; and, lastly, one of cystic oxide. Urinary calculi are composed of urates, &c.; or of uric acid; cystic oxide; carbonate of lime; oxalate of lime; triple phosphate of ammonia and magnesia; phosphate of lime; or of silica.

Mucus in the urine gives rise to cloudiness, and when in small amount the microscope detects altered epithelial cells. It may contain octahedral crystals of oxalate of lime, only distinctly seen with a high power.

Pus.—A deposit, resembling mucus, may be produced by pus from the diseased bladder, altered by the ammonia set free as the result of the decomposition of urea in the bladder. The urine is alkaline, contains triple phosphates, and is coagulated by acetic acid, but not by heat or nitric acid, unless albumen be present.

Fungi and **Vibriones** are readily detected by the microscope, and so are spermatozoa.

Mode of Testing for Albumen in the Urine.—Two tests must be employed—heat and nitric acid. On applying heat—the most delicate of the two tests—to albuminous urine in a clean test-tube, the albumen coagulates and produces a cloud varying in density. This only happens, however, when the urine is acid; alkaline urine may be loaded with albumen, yet heat will produce no deposit. In such a case the urine must be rendered acid by the addition of a drop or two of acetic or nitric acid, and heat then applied. So also, urine containing an excess of earthy phosphates, as mentioned in a preceding paragraph, will become cloudy on the application of heat; for this reason therefore we employ nitric acid, which dissolves the phosphates, but renders the albuminous deposit permanent. Nitric acid alone will coagulate albuminous urine, but it must not be trusted to, since it also often produces a whitish amorphous precipitate of uric acid, when the urine contains a large quantity of urates; this precipitate, which might be mistaken for albumen, is distinguished by its not being produced by heat.

When, therefore, we obtain a deposit by both heat and acetic or nitric acid, we may be sure that it consists of albumen.

Mode of Testing Purulent Urine.—On adding liquor potassæ to urine containing pus, it is rendered viscid, so that the mixture can hardly be poured from one test-tube to another. By the microscope numerous globular corpuscles, about the $\frac{1}{1000}$th of an inch in diameter, with smooth margins and granular surfaces, are seen floating in the liquor puris; each corpuscle contains one or more nuclei. On adding strong acetic acid, the cell-wall is dissolved and the nuclei liberated. See Fig. 7, *e*.

Blood in Urine.—The urine has a "smoky" hue; the blood settles in a brownish-red deposit at the bottom of the vessel. The blood *may* be bright when it comes from the bladder or urethra, or the urine is alkaline. But if the urine be acid, and the blood comes from the kidneys, there is the smoky hue. The microscope detects the blood-cells, which may be altered by the urine so as to be ragged in outline. See Fig. 7, *b*. If there be much blood, albumen will be detected, but there may be more albumen than is to be accounted for by the blood. In that case there is another cause for its presence.

Urine containing Sugar.—Diabetic sugar differs from cane-sugar; it has the same chemical composition as that contained in most kinds of fruit, commonly known as grape-sugar, or glucose.

Diabetic urine has a sweetish taste and odor, is generally of a pale color, is secreted in very large quantity—sometimes forty, fifty, or more ounces—and is of a high specific gravity, varying from 1025 to 1050; the worse the disorder, the higher will be the specific gravity. It was at one time thought that torulæ were developed only in saccharine urine. Many have proved the incorrectness of this view, and taught us that though often formed in acid diabetic urine, yet that they are not peculiar to it, being especially frequent in acid albuminous urine, or even in healthy acid urine after exposure to the air. The Penicilium glaucum and the yeast-fungus, which not unfrequently exist together in diabetic urine, are now known to be varieties of the same plant.

Several tests have been proposed for the detection of sugar in urine.

Moore's Test.—Add to the suspected urine, in a test-tube, about half its volume of liquor potassæ, and boil the mixture gently for a few minutes. If sugar be present, the liquid will assume a dark brown tint. If, on the contrary, the urine be healthy, it will only be very slightly darkened.

Care must be taken—as Dr. Owen Rees has pointed out—that the liquor potassæ does not contain lead, as it often will if it has been kept in a white glass bottle. When it does so, the sulphur in the urine produces a dark color with the lead, which might lead to an incorrect diagnosis. The test-solution should be kept in a green glass bottle, free from lead.

Fermentation Test.—Mix a few drops of fresh yeast, or a little of the dried German yeast, with the suspected urine, and then fill a test-tube with the mixture. Put some of the urine also into a saucer, and then invert the tube and stand it upright in this vessel, taking care that the tube is full and free from bubbles of air; set aside in a warm place, having a temperature of 80° Fahr., for twenty-four hours. If sugar be present, it begins very shortly to undergo the vinous fermentation, by which it becomes converted into carbonic acid and alcohol; which change will be recognized by the bubbles of carbonic acid causing gentle effervescence, and afterwards collecting in the upper part of the tube. If the urine is free from sugar, no gas will be formed.

Trommer's Test.—A little of the suspected urine is to be placed in a test-tube, and a drop or two of a solution of sulphate of copper added, so as to give the mixture a slight blue tint. A solution of potash is now added, in amount equal to about half the volume of urine employed; this will throw down a pale blue precipitate of hydrated oxide of copper, which, if there be any sugar, will immediately redissolve, forming a purplish-blue solution. We must then cautiously warm the whole over a spirit-lamp, without boiling it; when, if sugar be present, a yellowish-brown precipitate of suboxide of copper will be deposited. If there is no sugar, a black precipitate of the common oxide of copper will be thrown down. This test is very delicate, and will detect very small quantities of sugar.

Fehling's Test is a modification of the last. Instead of the fluids used in Trommer's test, a solution is prepared by dissolving 69 grains of sulphate of copper in five times its weight of water, and adding a solution of 268 grains of tartrate of potash, and 80 of caustic soda in an ounce of distilled water.

Runge's Test consists in evaporating a small quantity of urine, and adding to it a little sulphuric acid—one-sixth diluted. If sugar is present a black deposit of carbon is produced, but this happens with albumen.

Horsley's Test.—An alkaline solution of caustic potash, and chromate of potash in equal proportion, is added to urine. On boiling, if sugar be present, an oxide of chromium is produced, of a deep green color.

Quantitative Determination of Sugar in Urine (after Fehling).—Grape sugar, or glucose, holds cupric oxide (oxide of copper) in solution in presence of potassic hydrate (caustic potash), and reduces it to cuprous oxide (suboxide of copper) when the solution is heated. There is a fixed ratio between the amount of cupric oxide (oxide of copper) reduced, and of sugar used for the purpose. The salt of copper generally employed for the oxidation of the sugar is the sulphate; and it is ascertained that 1 equivalent of grape sugar will reduce 10 equivalents of cupric sulphate (sulphate of copper). A standard solution (named after Fehling) is therefore prepared by dissolving 34.65 grammes of pure crystallized cupric sulphate in 160 grammes of water, and then pouring it slowly on a solution of 173 grammes of pure crystallized sodic-potassic tartrate (double tartrate of potash and soda), which has been previously mixed with from 600 to 700 grammes of potassic hydrate (caustic potash) of sp. gr. 1.12. The mixture so obtained should next be diluted to 1 litre, and must be kept in small hermetically-sealed glass bottles, and in a dark place, in order to prevent its decomposition. 10 c.c. of this solution (Fehling's) will completely reduce .05 gramme of glucose.

The first step in the process is to dilute both the urine to be analyzed, and the copper solution.

1. Take 10 c.c. of the copper solution, and add to it 40 c.c. of distilled water, and put this diluted solution into a Florence flask.
2. Measure off 10 c.c. of the filtered urine, and dilute it to 100 c.c. with distilled water.
3. Fill, in the next place, a graduated burette with the diluted urine.

Now heat the flask containing the copper solution nearly to boiling. Having done so, remove it from the lamp, and let a portion of the urine in the burette gradually run into it. The solution will immediately assume a greenish reddish-brown color, and by allowing it to stand, in a very short while a reddish-brown sediment will fall to the bottom of the flask, and the supernatant liquid will now appear green. Replace the flask over the lamp, and heat as before. When the fluid has nearly reached the boiling-point let another portion of the urine in the burette run into it, and again allow the precipitate to settle. If the supernatant fluid in the flask be still green or geeenish-yellow, proceed as before, taking care to add the urine more slowly the nearer the process approaches completion. This point is reached when, by holding the flask between the eye and the light, after the addition of one or two more drops of urine into it, the supernatant fluid, on the subsidence of the precipitate, appears perfectly colorless, or assumes a pale yellow hue. Read off the number of cubic centimeters used for the purpose. Lastly, to ascertain whether the quantity of urine added exceeds, or falls short of, the exact amount necessary for the reduction of all the cupric oxide (oxide of copper), proceed as follows:

Filter the fluid, while still hot, into three test-tubes. To one add first a few drops of hydrochloric acid to render the mixture in it acid, and afterwards some sulphuretted hydrogen. If no black precipitate is formed, then it contains no copper, and therefore enough of the diabetic urine was used. To confirm this test, acidulate the second mixture in the test-tube with acetic acid, and add ferro-potassic cyanide (ferrocyanide of potassium), and if the above test were well performed, there should be no reddish-brown color produced.

Take now a clean test-tube, and pour some of Fehling's solution into it, and heat it to boiling; then let some of the filtered mixture in the third test-tube flow gently into it. If, at the junction of the two liquids, no reddish-brown or pale yellow discoloration appears, then it will be evident that the filtered solution contains no excess of sugar—*i. e.*, that more urine than necessary has not been added to it. If, however, you get evidence of excess, either of copper or sugar, in the mixture, the analysis must be repeated.

Supposing 20 c.c. of the diabetic urine solution were employed for the reduction of all the oxide in the copper solution, the question arises, What is the percentage of sugar in it?

Now 20 c.c. of the urine solution corresponds to 2 c.c. of pure urine; for 10 c.c. of urine were diluted to 100 c.c.

In 50 c.c. of the diluted copper solution there are 10 c.c. of the pure Fehling's solution, and as all the oxide contained in this quantity of the solution is entirely reduced by 0.05 gramme of sugar, it follows that the 2 c.c. of urine used in the analysis contains 0.05 gramme of sugar. Hence 2.5 will be the percentage of sugar in the diabetic urine. Thus the rule is: divide 5 by the quantity of cubic centimeters of urine actually present in the urine solution made use of, and the quotient will represent the percentage of sugar in the diabetic urine.

Kiestein.—This is a peculiar principle said to exist in the urine of pregnant women, and to become visible—when the secretion is allowed to repose in a cylindrical glass—in the form of a cotton-like cloud, which, after four or five days, becomes resolved into a number of minute opaque bodies, which rise to the surface and form a fat-like scum, remaining permanent for three or four days. In these cases the urine has a peculiar cheesy odor, and remains faintly acid until the scum or pellicle breaks up. The pellicle is made up of fatty matter, triple phosphates, and a substance like casein.

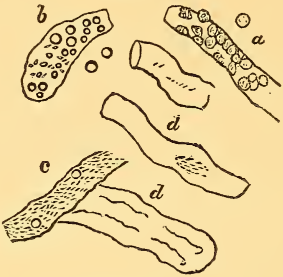
Casts.—In certain diseased states of the kidney, fluid—say serum—escapes into, or is formed—say it be pus—in the uriniferous tubes. This foreign material may take the shape—especially in the case of serum or blood which coagulates—of the tube, and being washed out, it may appear as a "cast" or mould of the tube. The composition of the cast may vary, of course. Then it may entangle any substances present in the uriniferous tubes, such as epithelial cells, blood discs, crystals, fat cells, &c., or it may be a perfectly transparent mould, supposing it to be simply coagulated serosity. Then, thirdly, the casts may vary in size according to the size of the uriniferous tubes. Suppose the lining of the tubes to be increased in thickness, then the "casts" may be small; supposing the tubes to be deprived of their epithelial lining, then the "casts" or "moulds" will be large. As the changes in the uriniferous tubes in different parts of the kidney cannot be the same in extent, the size and nature of casts will vary somewhat. Therefore we must be guided by the general character of the casts present in any particular case. Now the following are the more important varieties:

1. **Epithelial**:—these are small, about $\frac{1}{700}$ of an inch in diameter; they are moulds of the uriniferous tubes, due to a certain amount of outpoured serum, in which the shed epithelial cells are entangled. These are seen in early stages of acute disease. In the "acute desquamative nephritis" that follows scarlatina. There may be blood corpuscles and even pus cells in these casts. See Fig. 12, *a*.

2. **Granular Casts.**—In this form the epithelium is

broken down into débris, and it is characteristic of the chronic stage of desquamative nephritis. See Fig. 12, *c.*

Fig. 12.



a. Epithelial casts.
b. Oily casts.
c. Granular casts.
d. Large and small waxy casts.

3. **Purulent Casts**—may occasion a cloudy and ample deposit; they are coagulated fibrinous serosity, containing pus cells, and occur in acute disease, where suppuration is taking place—ex., nephritis.

4. **Blood Casts** are made up of coagulated fluid and blood discs.

5. **Waxy Casts.**—These are large, $\frac{1}{500}$ of an inch, or small, $\frac{1}{1000}$ inch. They are transparent, hyaloid, and glistening. These casts may be slightly granular. They indicate, when small, that the epithelial lining is still present in the kidney tubes, and when large, that it is lost.

But all waxy casts indicate serious disease of the secretory structure of the kidney. The name *oily casts* is given to fibrinous casts enclosing oil. Fatty change in the kidney may also be indicated by the presence of epithelial cells loaded with fat globules—a serious condition. In *chylous* urine the fat is in a molecular state. Free oil globules in the urine are of extraneous origin. See Fig. 12, *b*, *d*.

Bile in the Urine.—The coloring matter of the bile, when it exists in the urine, is readily detected, by the dark yellow color it gives to the secretion, by the yellow color it communicates to a piece of white linen dipped in it, or by the dark green and afterwards purple color which the urine assumes when a sufficient quantity of sulphuric acid is added to it in a test-tube, or on a white plate.

Pettenkofer's Test.—To a little urine placed on a piece of white porcelain, a few drops of strong sulphuric acid are added, and then a drop of strong syrup. When bile is present a purple color is produced.

Schwertfeger's.—The bile is precipitated by acetate of lead—yellow, it is then redissolved by alcohol, to which a little acid has been added; a green solution results, and to this Pettenkofer's test can be applied.

Iodide of Potassium in the Urine—may be detected by adding, first, starch to the cold secretion, and then a few drops of nitric acid (or solution of chlorine); the blue iodide of starch will be formed, if an iodide be present.

SECTION V.

MILK.

Milk is made up of oil globules, which, in consequence of their having a coating of casein, do not run together, but if acetic acid be added, this membrane is removed and the globules coalesce. The microscope detects chalk and starchy matters added for adulteration, and if animals' brains are added, nerve tubules, nerve cells, and bits of capillaries are detected.

SECTION VI.

SEROUS FLUIDS.

These may be allowed to stand a while, that any solid matters may settle; these may then be examined under the microscope. The bodies found in the contents of serous cavities are mainly epithelial and granules. If there be inflammation, we have more or less pus cells, shreds of fibrin, oil globules, spherical cells, cholesterine; in the fluid of hydatid cysts, hooklets are found, in that of hydrocele epithelial débris, spermatozoa occasionally, and cholesterine; in ovarian cysts will be found spherical, nucleated, or granular cells, granules, oil globules, and blood corpuscles.

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